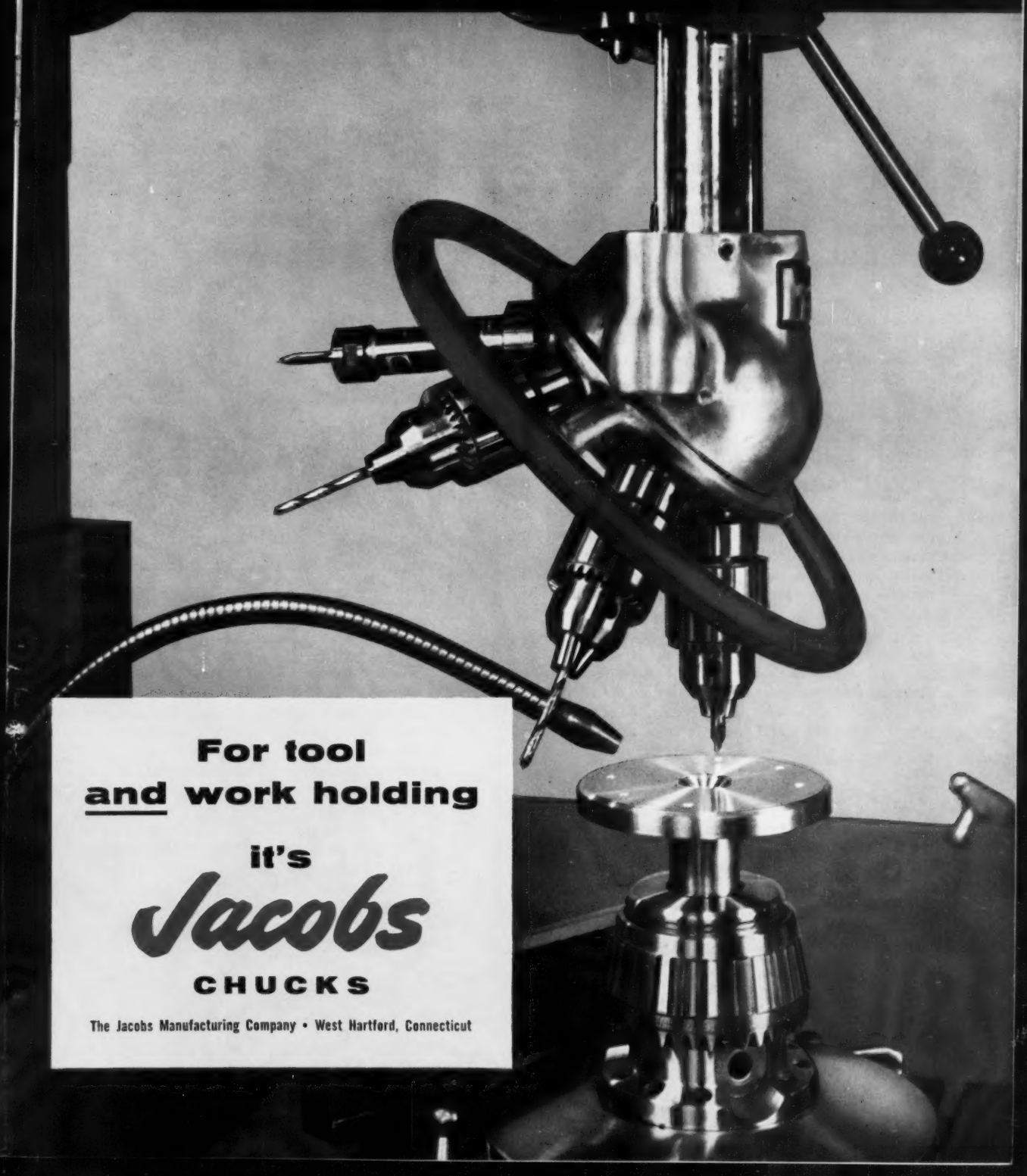
JUNE 1957 — SIXTY-THIRD YEAR

MACHINERY



For tool
and work holding
it's
Jacobs
CHUCKS
The Jacobs Manufacturing Company • West Hartford, Connecticut

Heald announces TWO NEW DEVELOPMENTS

THE NEW "RITE-ANGLE" CENTRI-MATIC

Clifford G. Menard
Chief Engineer,
Grinding Division

ANY new development that can cut grinding time by up to 50 per cent is important news. And since our new RITE-ANGLE Centri-Matic internals will do just that, some inside information on how this rather startling improvement was brought about may be of interest.

In order to permit heavier feeds and faster stock removal, we have *inclined* the wheelhead table at a 30 degree angle — to oppose feeding and grinding forces to best advantage.

With this new RITE-ANGLE construction, stock can now be removed at the rate of two cubic inches per minute without any distortion or unwanted movement of the table, keeping the wheel properly buried in the work. This compares to a previous maximum stock removal of about 1 cubic inch per minute.

The Model 190A and 1901A Centri-Matics utilize a new cycle and compensating diamond arrangement, especially designed to take full advantage of the faster feeds and automatically maintain optimum grinding intervals under varying conditions of work size and stock removal. Spindle pressure against the work during all portions of the grinding cycle is measured by an ammeter on the control panel, permitting proper roughing and finishing pressures to be established during the set up. The feed box controls will automatically maintain these pressures during the production cycle.

The RITE-ANGLE design can be likened to an iron hand in a velvet glove — giving greater strength where strength is needed, yet retaining the extremely high precision that is so essential to bearing race work.

THE NEW "UNIT-TYPE" BORE-MATIC

John J. McCabe
Chief Engineer,
Bore-Matic Division

THE unitized or "building-block" design has been applied to large automated machine tool equipment with considerable success. And now, with the development of the new Model 0 Unit-Type Bore-Matic, we have applied this same basic principle to a small, individual machine, with some very interesting results.

Designed around a number of standard, interchangeable units or "building blocks," the Model 0 is actually many machines in one — providing far greater versatility and economy than have ever before been available in a high-precision machine of this type. It can be arranged as a single or double end machine, with one or two boringheads or a multi-spindle unit at either or both ends. Hence it puts custom-built machine design on an "off-the-shelf" basis, meeting the exact requirements of any small-work Borizing job.

One of the outstanding features of this machine is a new MULTI-SPINDLE Boringhead that offers the first practical solution to the problem of Borizing multiple holes on close centers. Heretofore this has had to be done, one hole at a time, on large, costly equipment requiring high operator skill. But with the new MULTI-SPINDLE head, any practical number of holes, with centers as close as ¾", can be Borized simultaneously and duplicated again and again with extremely high accuracy. Individual Red Head boringhead spindle units are mounted in interchangeable spindle plates, jig bored to the requirements of each job. This completely flexible clusterhead arrangement puts multi-hole, close-center Borizing on a low cost, production basis.

THE HEALD MACHINE COMPANY • Subsidiary of The Cincinnati Milling Machine Co. • **Worcester 6, Massachusetts**

For further details see Pages 34 and 35

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Machinery

VOLUME 63 JUNE 1957 NUMBER 10

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

Improved Production of Direct-Current Motors and Generators *By G. William Ambro* 141
Which Type Wheel for Surface Grinding? .. *By A. R. Miller, Jr.* 152
Stretching and Drilling Techniques for the Jet Age. *By Ray Ortiz* 155
Billions of Fasteners Each Year ..... *By Harold W. Bredin* 158
Latest Techniques in Extruding Aluminum . *By Charles H. Wick* 166
Welding Stainless Steels ..... *By Richard E. Paret* 185

MACHINE AND TOOL DESIGN

Preventing Machine Damage with Electric Clutches and Brakes *By W. E. Timmcke* 164
Automatic Machine Speeds Connecting-Rod Assembly 174
"Hall of Titans" Grinding Machines Pack High Horsepower 177
Air Ejector for Punch ..... *By Roger Isetts* 183
Forming Tapers in Die Members ..... *By Frank D. Rifner* 183
Development of a Sheet-Metal Cone ..... *By Donald E. Sweet* 184
Huge Transfer Press Produces Two Stampings without Changing Dies 193
Ram-Operated Knockout for Second-Operation Dies *By Federico Strasser* 197
Machining Chevron Type Teflon Gaskets ..... *By A. Pearl* 198
Turret-Lathe Tool Pierces Thin-Walled Tubes. *By William Morson* 198
American Standard Formulas for Bolt Heads and Nuts (Data Sheet) 249

MANAGEMENT PROBLEMS AND MEETINGS

Are There Really Obstacles to Hiring Older Workers? *By Charles O. Herb* 139
A Machine Shop Teacher Appraises His Profession *By Richard M. Outcalt* 148
Who Will Make Your Present Equipment Obsolete? *By Bernard Lester* 182
Machine Tool Builders Addressed by Government Officials 200

DEPARTMENTS

Keeping Up with Washington 137
Materials of Industry 171
In Shops Around the Country 180
Talking with Sales Managers 182
Shop Kinks 183
Problem Clinic 184
Reference Section 185
Tool Engineering Ideas 197
The Latest in Shop Equipment 202
New Catalogues 229
Between Grinds 240
News of the Industry 242
Data Sheet 249
Coming Events 252
New Books and Publications 254

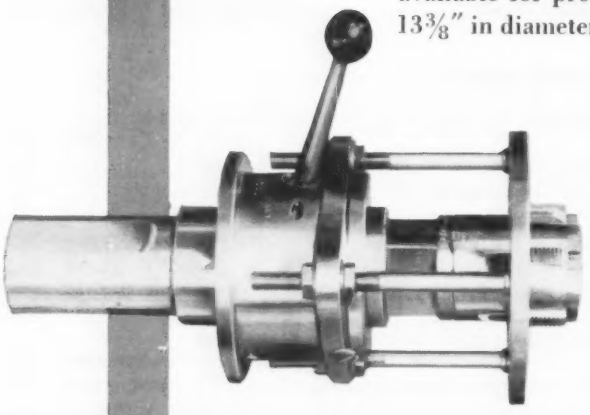
Product Directory 296

Advertisers Index 377-378

LANDIS Collapsible Taps

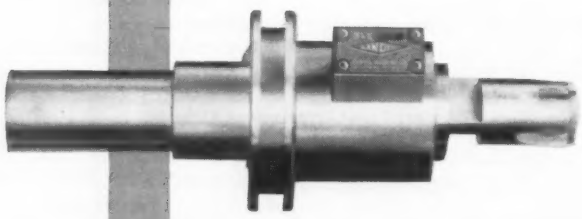
Sensitive Collapsing Action

The design of LANDIS Collapsible Taps reduces tool wear, "torn" threads and tapping time by permitting direct removal from the workpiece without reversing or "backing out". The sensitivity of this "collapsing action", which automatically withdraws the chasers from the completed thread, assures uniform thread lengths and threading to a shoulder with safety . Various sizes of LANDIS Taps are available for producing straight or tapered threads from $1\frac{1}{4}$" to $13\frac{3}{8}$" in diameter.



ALT TAPS for straight threads

These taps feature a rugged construction and design simplicity which enable maximum chaser rigidity. The same tap may be used for either stationary (shown) or rotary application. Tapered threads can be tapped using chasers cutting across their entire width.

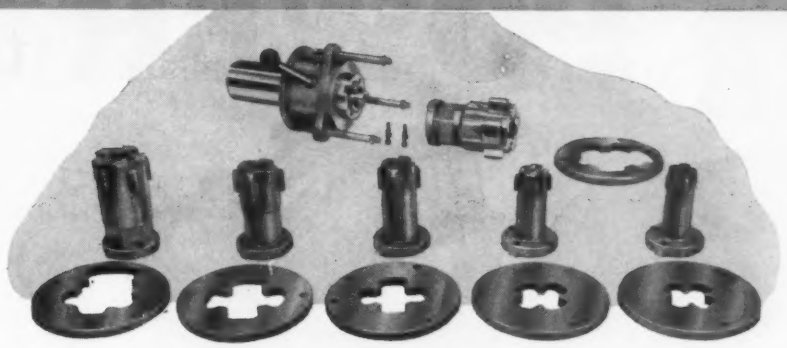


LL TAPS for tapered threads

The thread taper is produced by mechanical receding action of the chasers during threading. This action reduces cutting strains by restricting cutting action to the chaser throat or chamfer section. As little or no "cold working" can result, LL Taps are ideally suited for tapping tapered threads in stainless steel. These taps will also produce straight threads, and are available for either stationary or rotary applications.

Sensitive Collapsing Action

Straight or Tapered Threads **Rotary or Stationary Use**

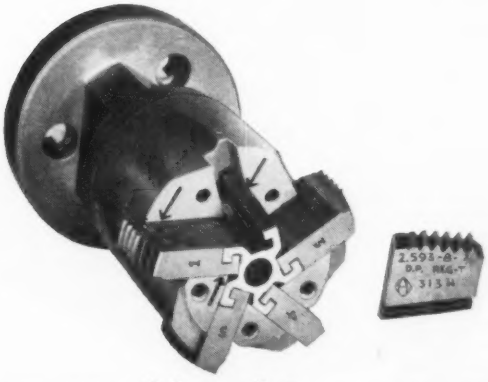


Wide Range Coverage

Detachable heads are a feature of all LANDIS Collapsible taps. This design allows tapping a wide range of thread diameters with minimum tooling—for example, the 3ALT body using 6 different heads will tap all diameters from 1¼″ to 3¼″. Each tap head itself has a wide threading range—the 1½″ head will thread from 1⅜″ to 1⅝″, the 2″ from 1⅞″ to 2-5/16″, the 3″ from 2¾″ to 3¼″.

Maximum Rigidity

The basic design of all LANDIS Tap Heads assures maximum bearing support between the chaser, plunger and tap head body. In the cross-section illustration, note the heavy metal sections which provide rigidity to the chasers and plunger, particularly at the points where cutting strains are transmitted.



Size Adjustment Ease

All LANDIS Taps are designed so that they may be quickly adjusted approximately 1/32″ over or under the nominal chaser size. The ratchet-type size-adjusting screw is conveniently located in the front of the tap. The movement of one ratchet tooth provides a self-locking diametrical adjustment of .001″.

LANDIS *Machine* COMPANY

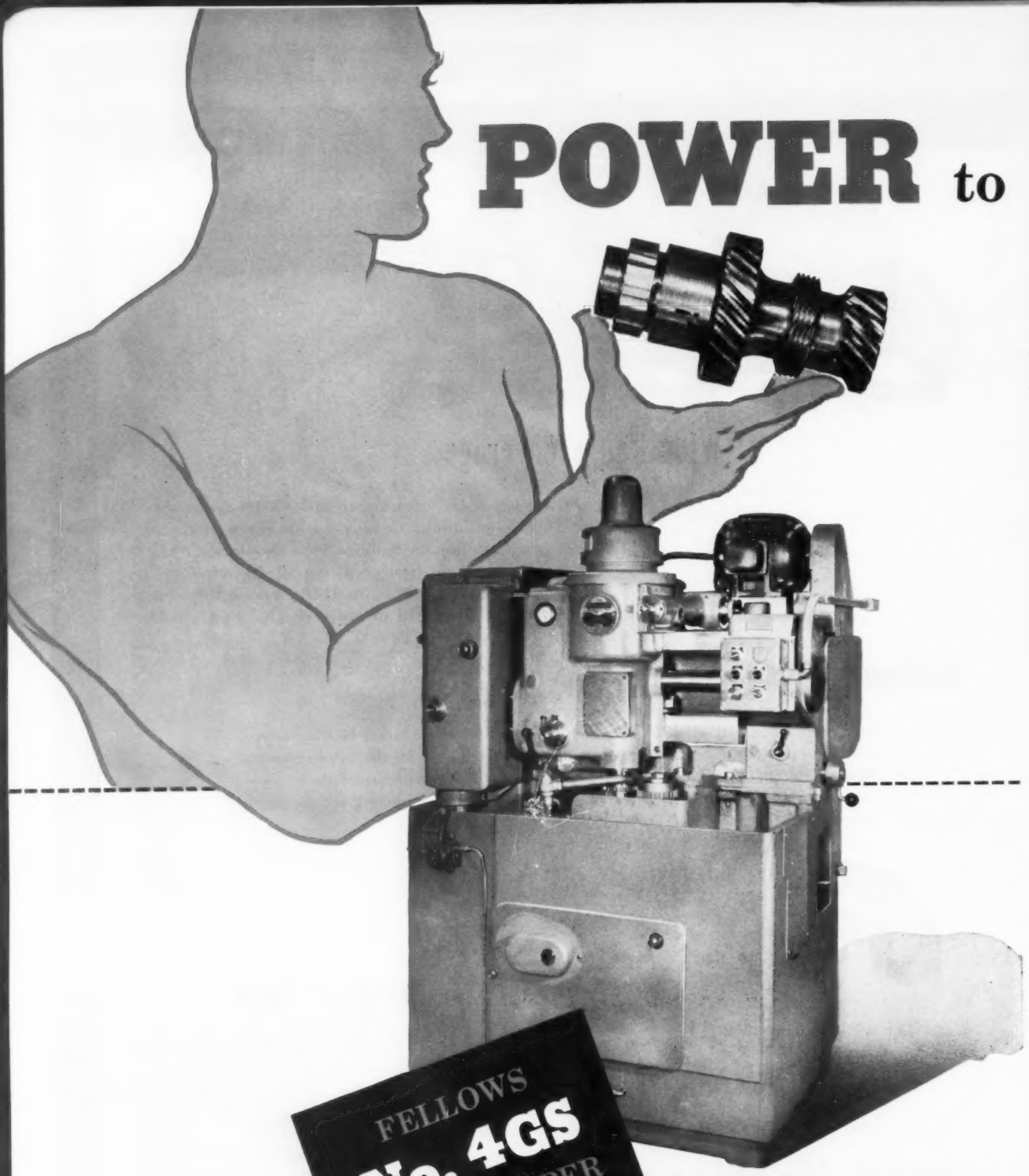
WAYNESBORO • PENNSYLVANIA • U. S. A.

430-C THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

Straight or Tapered Threads **Rotary or Stationary Use**

For more information fill in page number on Inquiry Card, on page 229

POWER to



FELLOWS
No. 4GS
GEAR SHAPER

THE
PRECISION
LINE

Lower Gear Production Costs

Performance figures of Fellows No. 4GS Gear Shapers on many production lines prove that these high speed machines pay "profits" in lowered costs everywhere they're used. One major manufacturer has installed 10 new No. 4GS Gear Shapers because each cuts 30% faster than his older machines, saves in set-up time, too.

The new Fellows No. 4GS Gear Shaper finish-cuts internal and external spurs and helicals up to 6″ P.D. and 2″ face width, at 9 cutter speeds from 98 to 635 strokes per minute. Rigid mechanism assures close tolerances at all speeds. For large production runs, it can be readily adapted to operate semi-automatically or completely automatically. And the versatility of the No. 4GS Gear Shaper permits fast, efficient cutting of a nearly infinite variety of cams, splines and special contours.

For full information about the complete Precision Line of Fellows Gear Production and Inspection Equipment, get in touch with your Fellows representative. Write, wire or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
5835 West North Ave., Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

For more information fill in page number on Inquiry Card, on page 229

Inside Story of a

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES

Smart Buy for Your Shop . . .

It's a good idea to look "under the hood" when buying machine tools. Hidden features may give you some real clues to the machine's potential for your particular objectives. A quick look "under the hood" of CINCINNATI® ML and MI Milling Machines reveals a host of features that work unseen toward the common goal of every shop . . . to reduce the cost of production. Six features are illustrated below. Of course, there are many more, such as:

Automatic lubricating systems for column and knee reduce preventive maintenance

Knee and column oil filters may be removed from outside machine

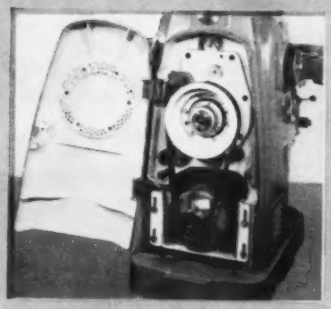
Hydraulic shifting of spindle drive gears gives the operator an assist

Live power rapid traverse at the rate of 150" per min. aids the setup man

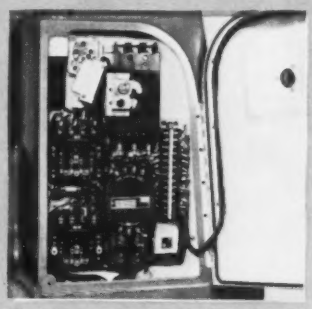
Big selection of standard attachments

CINCINNATI ML and MI Milling Machines are unquestionably a smart buy for your shop. Would you like to have more information about these machines? For brief data look in Sweet's Machine Tool File. Or, for complete specifications, write for a copy of catalog No. M-1916-1.

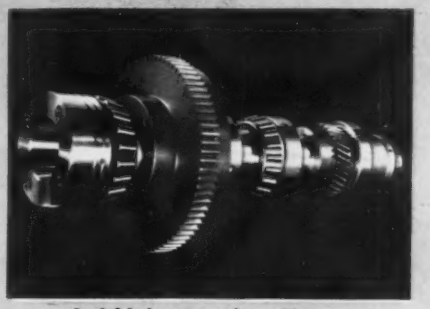
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



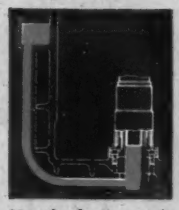
Cradle type mounting for spindle drive motor greatly simplifies removal and servicing of the motor.



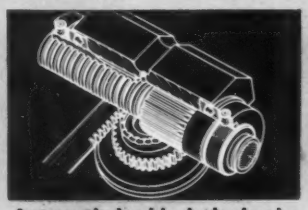
Electrical controls are built-in and completely enclosed for protection against accidental damage, dust and cutting fluid.



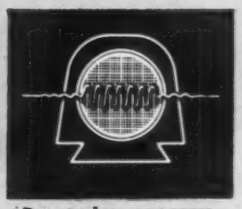
Anti-friction mounting with center support for the heavy spindle assembly, smoothly transmits maximum cutting power.



Vertical screw is submerged in a bath of oil from its own reservoir, assuring long, accurate life.



Automatic backlash device increases productivity. Machine can mill equally well as the table feeds to the right, left or alternately right and left.



Dynapoise overarm smooths out the cutting action; provides straight-edge alignment for arbor supports.

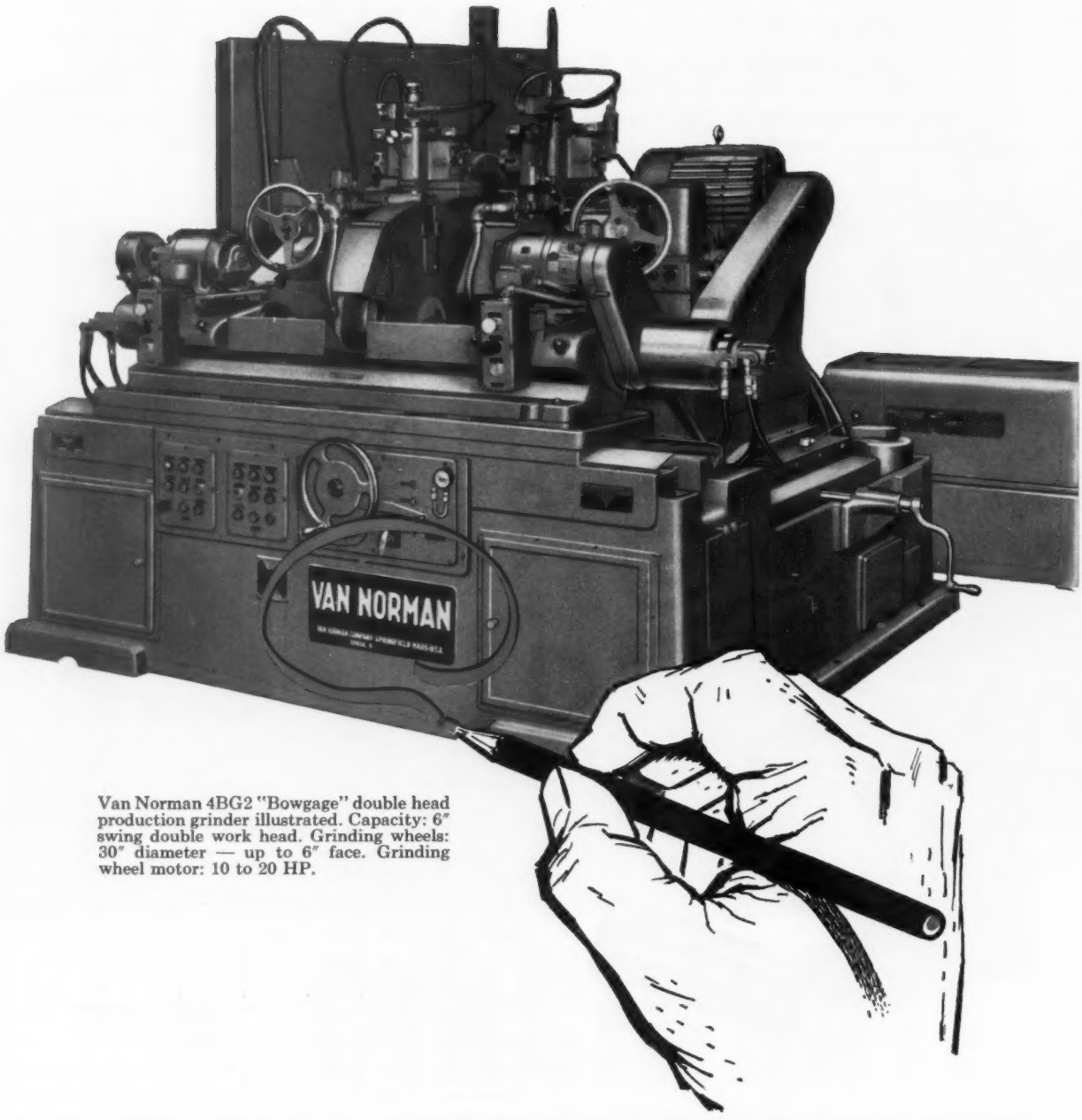
Brief Specs CINCINNATI ML and MI Milling Machines

Size	No. 2 ML		No. 2MI			No. 3MI	
Style	Plain	Univ.	Plain	Univ.	Vert.	Plain	Univ.
Range: Longitudinal	28"	28"	28"	28"	28"	34"	34"
Cross	10"	10"	10"	10"	12"	12"	12"
Vertical	16½"	16"	19"	18"	14"	20"	19"
Sixteen Spindle Speeds	25-1500 rpm all sizes and styles (higher and lower ranges optional)						
Sixteen Feeds	¼-30" per min., all sizes and styles						
Motor Drive: Spindle	3 hp	3 hp	5 hp	5 hp	5 hp	7½ hp	7½ hp

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

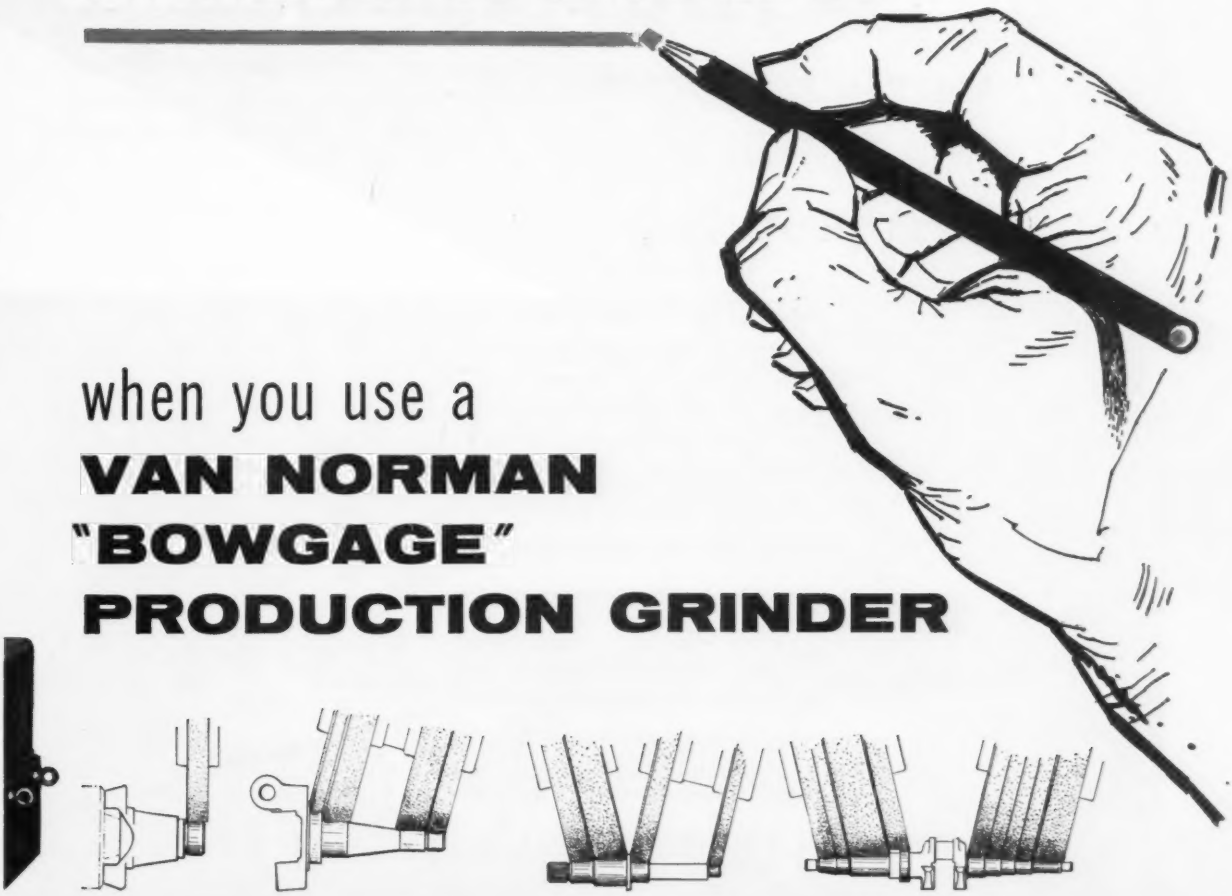
For more information fill in page number on Inquiry Card, on page 229

The Accent is on



Van Norman 4BG2 "Bowgage" double head production grinder illustrated. Capacity: 6" swing double work head. Grinding wheels: 30" diameter — up to 6" face. Grinding wheel motor: 10 to 20 HP.

Production



when you use a
VAN NORMAN "BOWGAGE" PRODUCTION GRINDER

Here are sketches of several actual applications performed for users of single and double head Bowgage Production grinding machines.

"Engineered for the job," the Van Norman 4BG "Bowgage" Production Grinder gives you accurate, fast, economical mass production.

Actual case histories on these massive grinders continually show substantial savings by keeping production up and costs down.

Van Norman production grinders can help you with your mass production problems. Write, wire or telephone, today, for complete details on the Van Norman 4BG "Bowgage" Production Grinders.

Don't wait . . . for extra profit install a Van Norman "Bowgage" Production Grinder now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

VAN NORMAN MACHINE COMPANY

SPRINGFIELD 7, MASSACHUSETTS

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

For more information fill in page number on Inquiry Card, on page 229

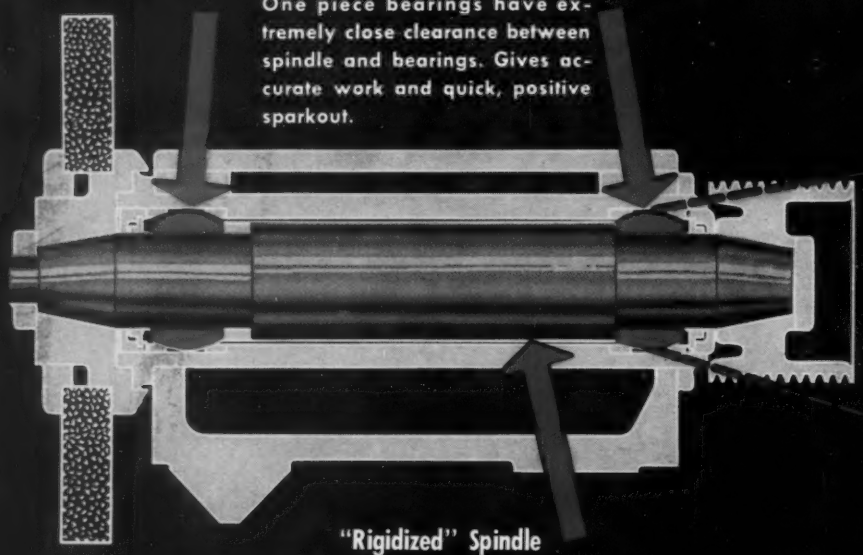
Only Landis grinders have "rigidized" bearings and spindles

for

- **maximum production**
- **fine finishes**
- **high precision**

"Rigidized" Microsphere Bearings

One piece bearings have extremely close clearance between spindle and bearings. Gives accurate work and quick, positive sparkout.



"Rigidized" Spindle

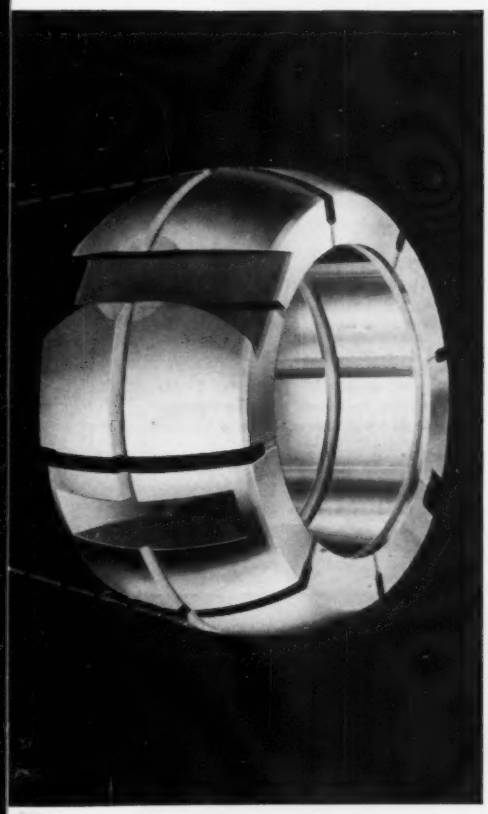
Because the diameter of the spindle between bearings is increased, you can take heavy cuts without loss of accuracy or finish.

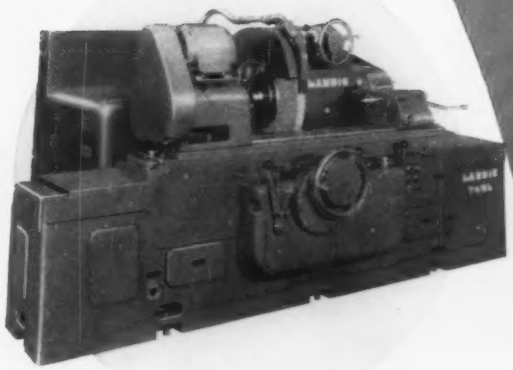
LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

Landis Universal Grinders have rigidized Microsphere bearings and spindle.

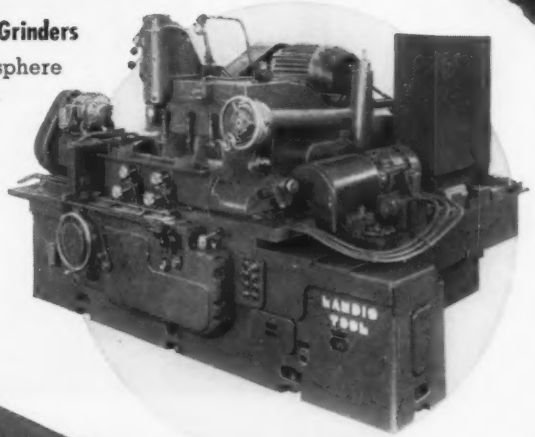




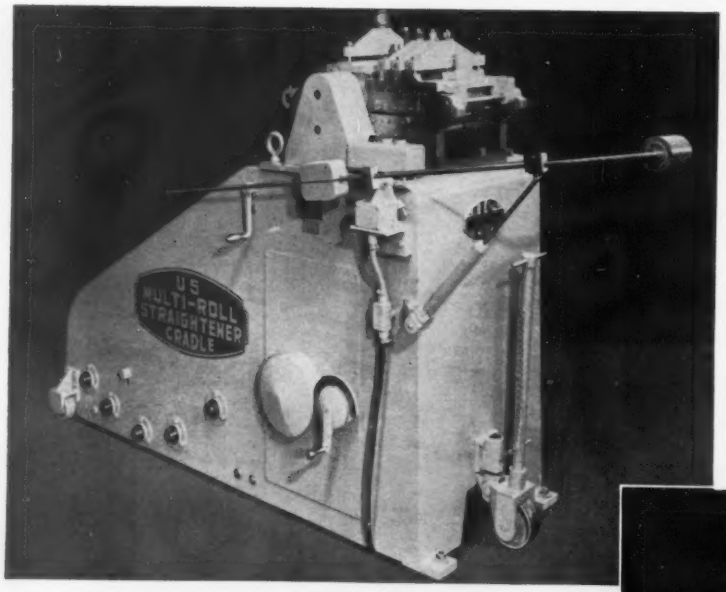
Landis Plain Grinders have rigidized Microsphere bearings and spindle.

Landis Centerless Grinders have rigidized Microsphere bearings and spindle in both the grinding wheel and regulating wheel heads.

Landis Single-Purpose Grinders have rigidized Microsphere bearings and spindle.



Use U S PRODUCTS

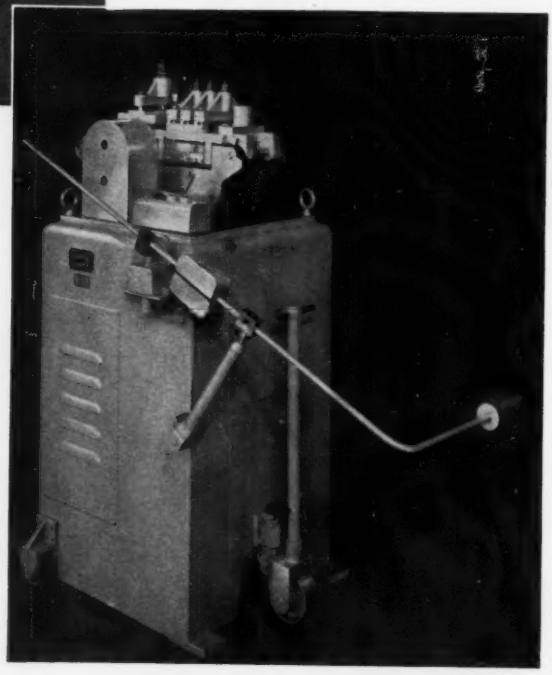


Left: Model PDSC-940 U. S. Combination Coil Cradle and Power Driven Straightener (portable type) for material up to 9" wide, 1/8" thick, coils with O.D. up to 40". Includes 2 H.P. variable speed drive motor. Also made in other sizes.

Below: Model PDS-4 1/2 U. S. Power Driven Straightener (portable type) for material up to 4 1/2" wide by 1/8" thick. Equipped with 1/2 H.P. variable speed drive motor. Also made in other sizes.

Opposite page, left: Model SF 24-24 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 24" wide, mounted on a Straight Side Press.

Opposite page, right: Model SF 12 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 4 1/2" wide, mounted on a Minster High Speed Gap Press.



★ **U. S. PRODUCTS**

Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Wire Straighteners
Die Sets
Multi-Slides®
Multi-Millers®

—Reduce Pressroom Costs!

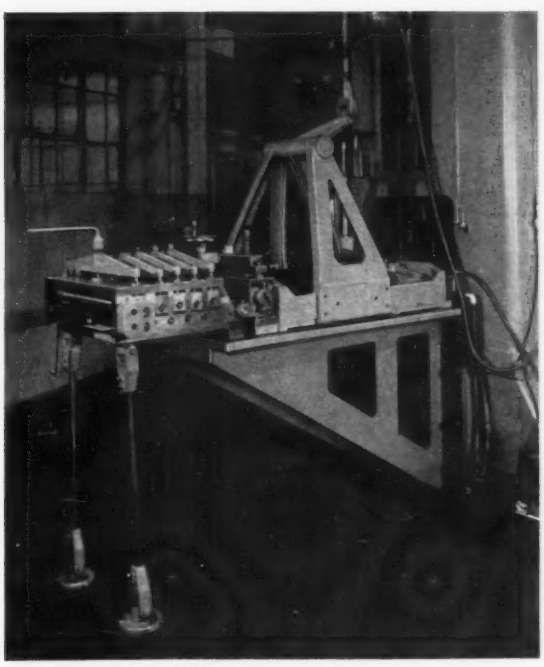
Don't allow inefficient operations to devour your profit margin. U. S. Automatic Press room Equipment is designed and built to help you effect savings in the production of stampings.

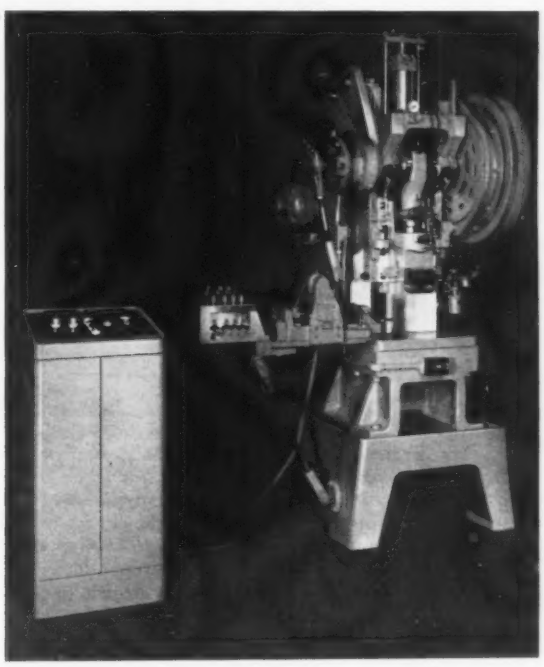
The use of coil stock in your punch press operations should result in very definite savings, and these savings can only be completely assured by using automatic equipment in conjunction with your presses. The illustrations show just a few of the many different units included in the U. S. line for the efficient feeding, straightening and holding of coil stock.

Investigate to see if you are effecting all the cost reductions possible in your press room operations. Ask for a copy of Bulletin 80-A.

U. S. TOOL COMPANY, Inc.

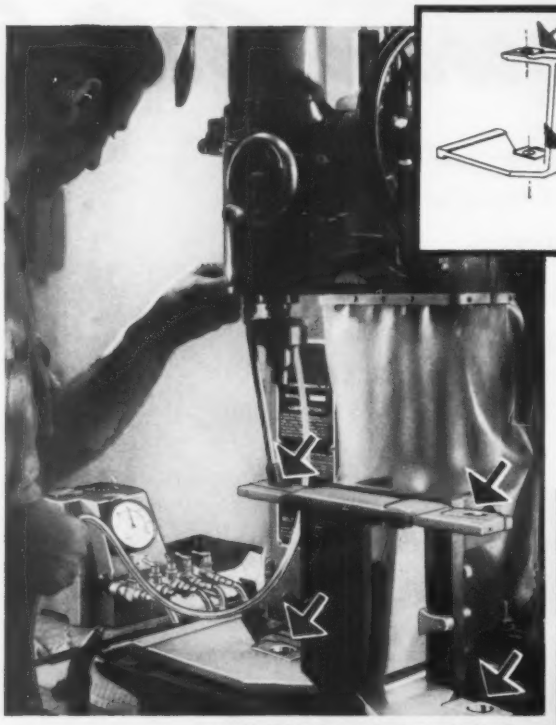
Ampere (East Orange) New Jersey

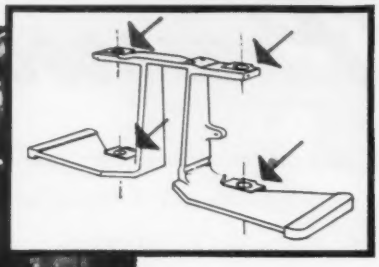




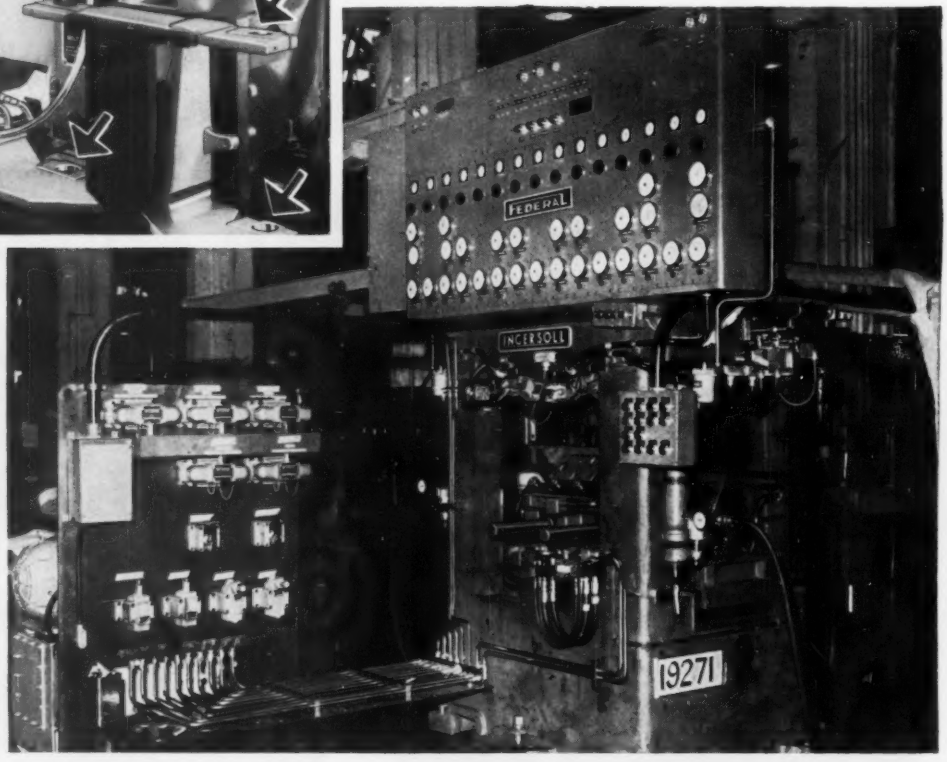
For more information fill in page number on Inquiry Card, on page 229

THEY GAGE THESE





This application at the Arrow Tool Company, Inc., illustrates the adaptability of the Dimensionair. Here it is equipped with a 5-way manifold to which different gaging units are attached ready for other jobs. On this job a Model A-1250 Adjustable Bore Gage is used to inspect 4 holes. Note that with this particular gage the handle does not have to line up with the hole. Many other jobs, having tolerances from .0004" to 50 millionths, are inspected by this Dimensionair.



Federal air-electric gaging and classifying equipment was used in this gaging station on an engine block transfer line. Two diameters in each of five crankshaft bores and two each in five camshaft bores are measured — twenty holes in all. After automatic assembly, oil holes in the five bearing liners are checked for alignment with the holes in the camshaft bores. All conditions are checked simultaneously. Signal lights indicate all dimensional conditions. Unsatisfactory blocks are automatically rejected. Cycle time is well within production cycle time. Ingersoll Milling Machine Company supplied the handling and positioning units.

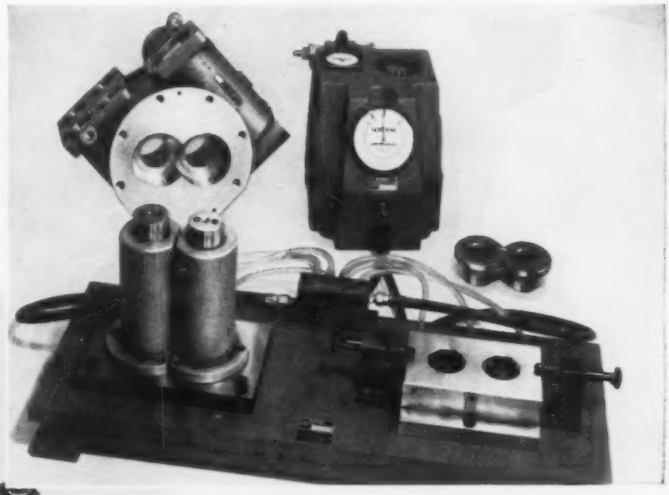
JOBS BETTER

with the DIMENSIONAIR

The increased complexity of more and more of today's gaging requirements calls for the utmost in dependable accuracy. So many times the accuracy of one dimension is dependent upon the accuracy of another. Automation, too, brings in another set of complications where misbehavior of the gaging process can upset your whole schedule.

The dependable no-drift accuracy of the Dimensionair is of the utmost advantage in such cases. Its reliability keeps quality up and keeps production rolling. Even on the simpler jobs the dependable no-drift accuracy and the foolproof operation of the Dimensionair are definitely appreciated. Call on us if you want to do a better gaging job. See our address below.

Two differential type Dimensionairs are used on this precision assembly. The first step is shown at right. Parallel bores in a gear-type fuel pump housing are located on the twin gaging plugs and the bushings that are to be pressed into these bores are placed in the twin ring gage at the right. The Dimensionair shows whether the flange flats on the bushings will have the proper clearance when bushings are assembled in the housing.



A second gage is used for the next step. After the bushings are inserted in the housing, they are located on the left hand pair of gage plugs. Then, a different set of bushings for the cover plate is placed on the right hand plugs. The single dial on this gage shows whether the center distances in the two pairs of bushings are the same within a tolerance of ±.0005". If the first two cover plate bushings measured do not meet this standard, others can be tried until a pair is found that does. Proper alignment of these bearing surfaces is assured at final assembly.

FEDERAL PRODUCTS CORPORATION • 7116 EDDY STREET, PROVIDENCE 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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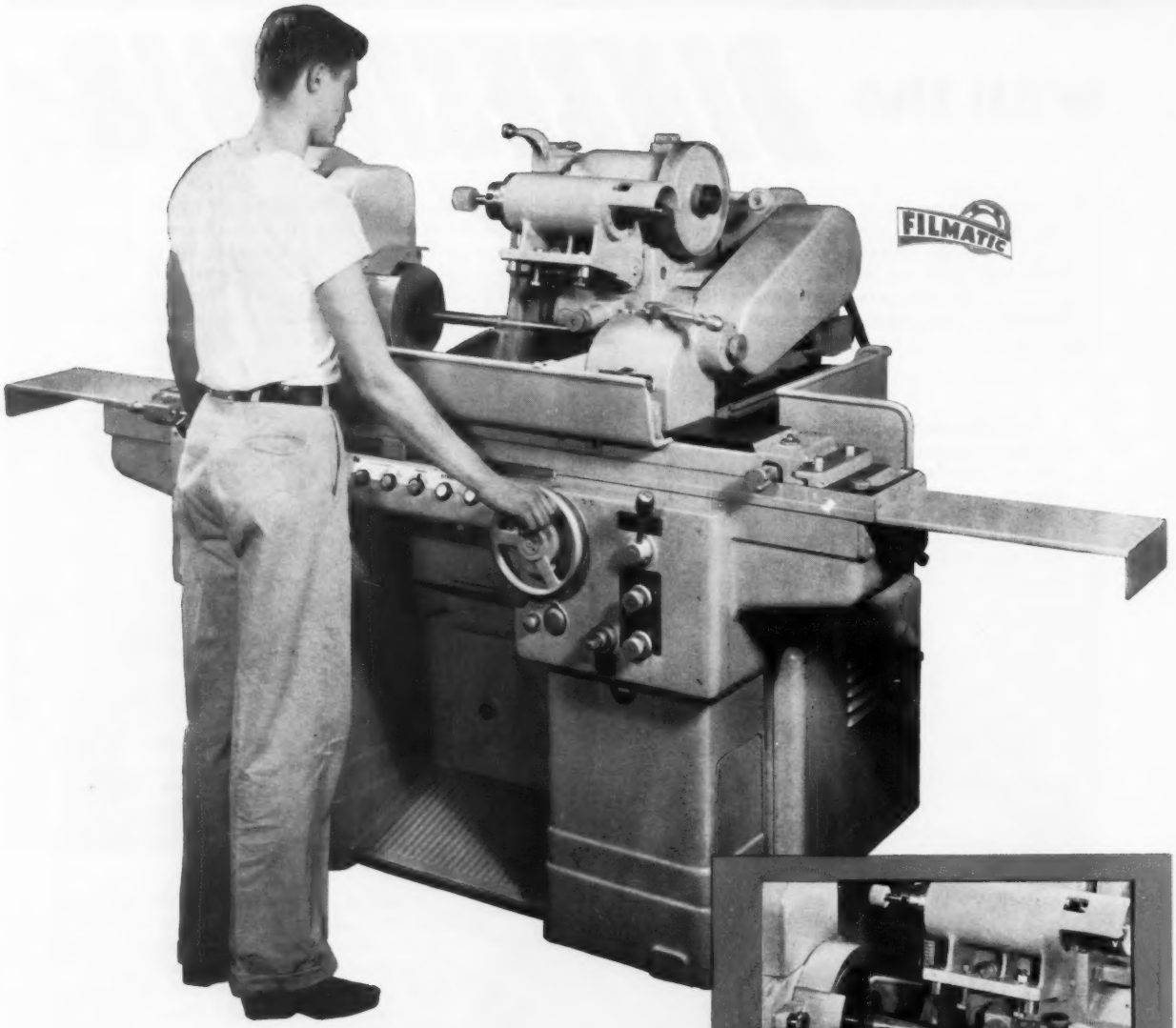
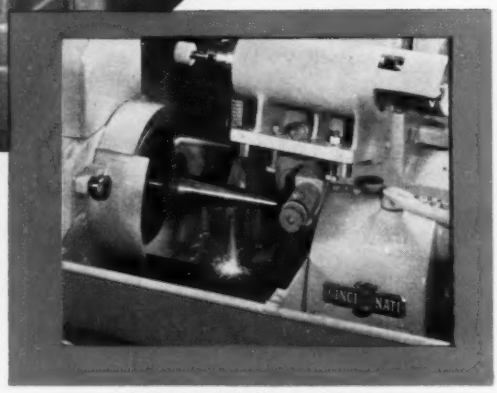
UNIVERSAL

This CINCINNATI Precision



Grinding a slender shaft . . . one of many types of precision toolroom and production grinding operations performed on CINCINNATI FILMATIC 10" Universal Grinding Machines.



Traverse grinding a taper. Amount of taper ground on these machines can be as much as 4½" per foot.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

UNIVERSAL

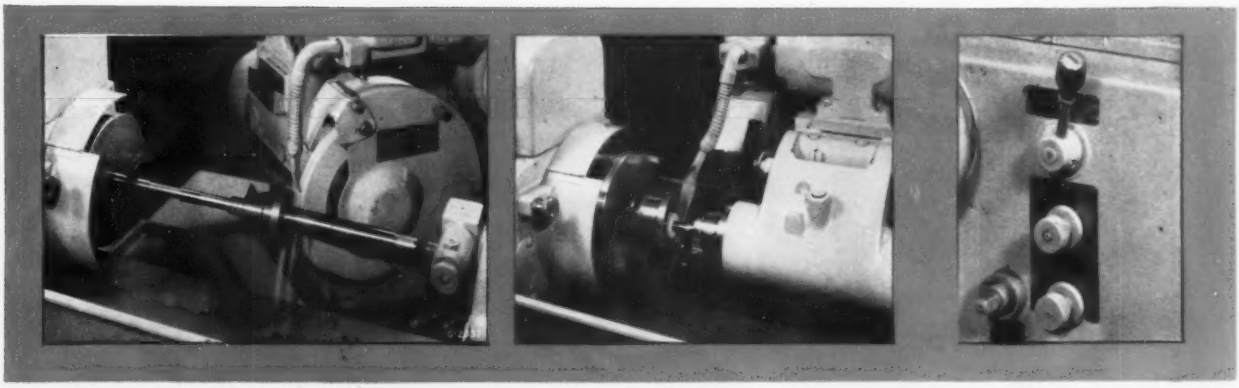
Grinds One Part or Hundreds

Look at your universal grinders from this viewpoint: when the need arises, can they handle big quantities at the low cost expected of high production equipment? It's routine work for the CINCINNATI® FILMATIC 10" Universal illustrated here. In addition to an unusual degree of versatility, this machine is equipped for automatic infeed grinding. For this type of work, a movement of one hand initiates the complete grinding cycle . . . rapid advance wheel to work, grind, tarry, return, and start and stop headstock rotation and coolant flow. ¶ The 10" Universal's extra measure of power is a big factor in both toolroom and production work. Consider these items compared to other machines in its class:

Largest grinding wheel: 12" diam. x 1½" face
Most powerful wheelhead motor: 2 hp
50% larger headstock motor
Exclusive FILMATIC grinding wheel spindle bearings

In addition to all these production advantages, the CINCINNATI FILMATIC is a true universal. Wheelhead swivels 180° and 220°, upper and lower, respectively; headstock swivels 180°; headstock speeds are infinitely variable 60 to 600 rpm. Want more information? Sweet's Machine Tool File contains brief specs. Complete data in catalog No. G-577-5.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Interchangeable drive and grinding wheel, for grinding the right-hand face of shoulders. An excellent finish is produced with this equipment.

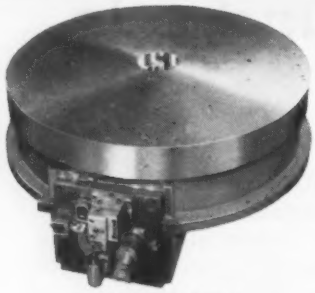
Internal grinding, one of the many operations performed at low, low cost on CINCINNATI FILMATIC 10" Universal Grinding Machines.

Automatic infeed elements. This type of equipment is built-in at the factory, does not restrict versatility of the machine in any way.

GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

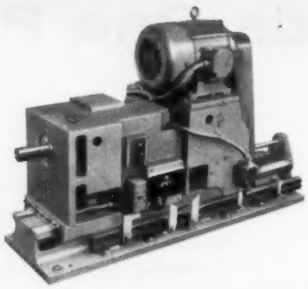
For more information fill in page number on Inquiry Card, on page 229

BECAUSE MAJOR COMPONENTS



STANDARD
ROTARY INDEX TABLE

available in 4 different table diameters, any practical number of indexes . . . permits use of a variety of work-holding fixtures . . . adapts to other machine designs.



STANDARD
WAY-TYPE DRILL UNIT

for drilling, boring, reaming, counter-boring and chamfering. Single and multiple spindle arrangements, single or double feed rates.

KEARNEY & TRECKER TAKES OF PRODUCTION

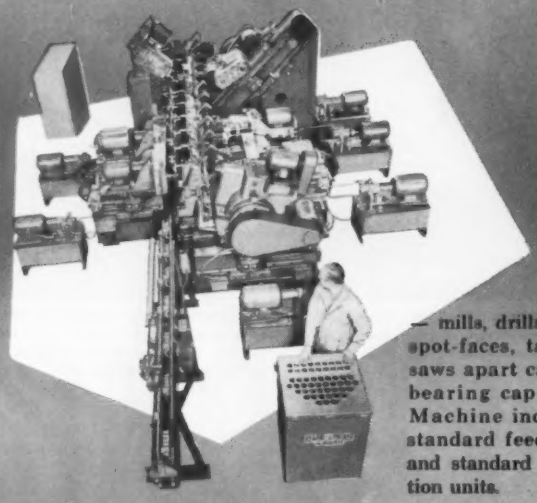
Here's a sound, proven *economical* approach to your production machine tool problems... Kearney & Trecker production machine tools featuring standardized components.

You get IMPORTANT SAVINGS — benefit directly three ways: (1) lower initial cost; (2) less lead time needed and (3) proven standard units mean efficiency *plus* simplified maintenance.

Ask the Kearney & Trecker man — he'll show you more examples of standardized machine components in production machine tools — the keys to capturing more profits from production!

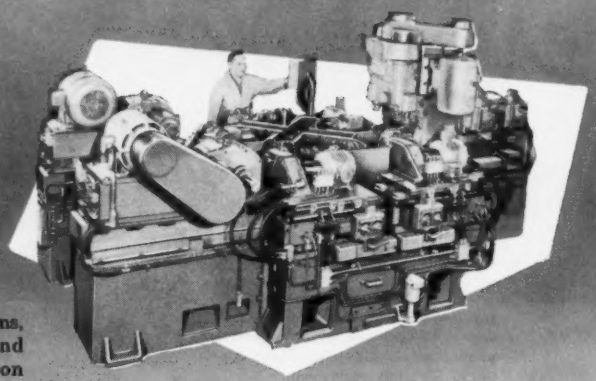
Integrated standard components meet

THIRTEEN STATION
AUTOMATIC TRANSFER MACHINE



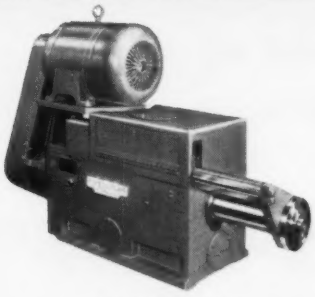
— mills, drills, reams, spot-faces, taps and saws apart cast iron bearing cap blocks. Machine includes 5 standard feed slides and standard production units.

FOUR STATION
ROTARY TRANSFER MACHINE



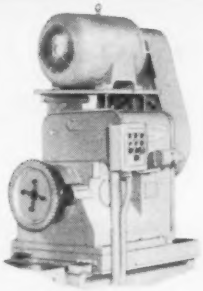
— New rotary transfer design permits machine to mill and center drill the ends and mill locating notches on crankshafts. Four standard feed slides, 3 standard production units are used.

ARE STANDARDIZED . . .



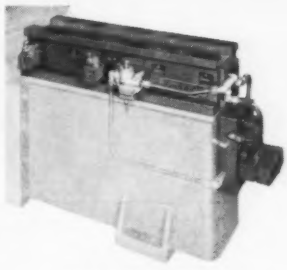
STANDARD QUILL FEED UNIT

for drilling, boring, reaming, spotfacing, counter-boring, chamfering. Single or multiple spindle arrangements — single or double feed rates.



STANDARD MILLING HEAD UNIT

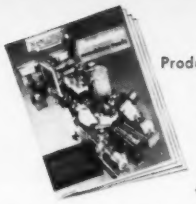
4 sizes. Single spindle . . . various horsepower and speed ranges . . . Single or double reduction drive . . . automatic quill retraction. Any size can be modified for boring.



STANDARD FEED SLIDE UNIT

provides hydraulic feed for milling, boring or drilling heads. Available in four sizes; various length cylinder strokes.

THE "SPECIAL COSTS" OUT MACHINE TOOLS



ASK FOR FREE KEARNEY & TRECKER
Production Machine Tools Bulletin SMD-57.
It provides full standardized component details — and their application to production machine tools.

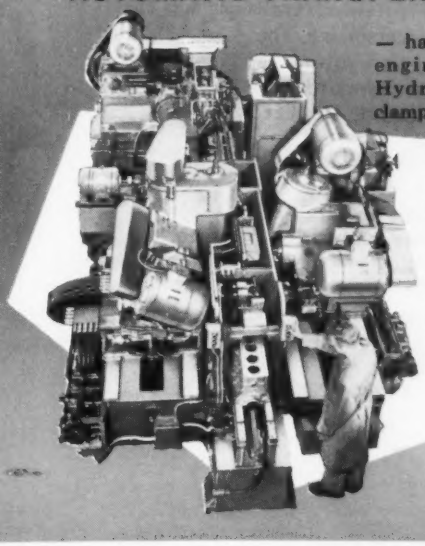
KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE ®

Designers and Builders of Precision and Production Machine Tools Since 1898

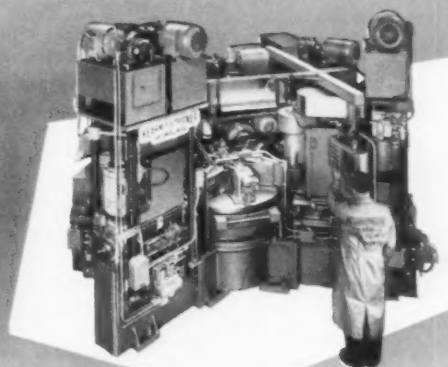
multiple machining requirements

SIX STATION AUTOMATIC TRANSFER MACHINE



— handles two different engine cylinder blocks. Hydraulic locating and clamping fixtures are a feature of this Kearney & Trecker which mills the mounting pads, push rod cover face, ignition boss, fuel pump pad and ends of blocks. Machine has 2 standard feed slides—4 standard milling heads.

SIX STATION ROTARY INDEXING MACHINE

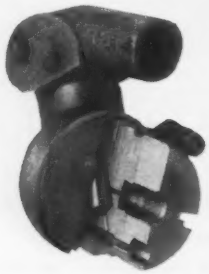


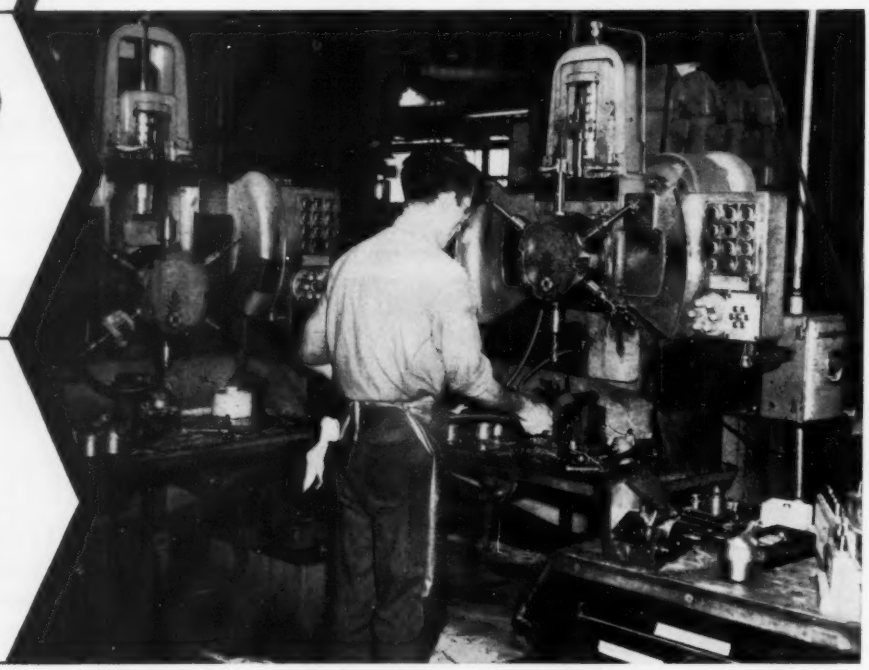
two such machines replaced six obsolete tools for a communications equipment manufacturer. Basically 70% standard, machines incorporate 7 Kearney & Trecker standardized components. Use of overhead hydraulic units saves floor space.

-40%

"Job costs reduced up to 40%

with our two BURGMASTER® turret drills"





So states The H. K. Porter Company, Somerville, Mass.

As the illustration shows, they use one operator to handle two Model 2BH Burgmaster 6-spindle automatic hydraulic turret drills. The part (cross sectional views of 2 sides shown) is an 1117 steel forging and the work on this job consists of a total of 22 operations involving drilling, tapping, reaming, counterboring and countersinking. The operator reports close concentricity held on all operations with good finish and depth control and with plenty of time to inspect work while machines are running. Setup time is reduced and greatly simplified.

AUTOMATIC HYDRAULIC BURGMASTERS (6- and 8-spindle models) feature skip indexing, automatic cycling and infinitely variable preselective feeds. All models (automatics, manuals, radials) provide power indexing, preselective spindle speeds and very close preselective depth control. Capacities from 3/8" to 1½" available.

For complete details, write Dept. M-6

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California

RIDGEWOOD, N. J. • CHICAGO • CLEVELAND • DETROIT • SAN LEANDRO, CALIFORNIA

For more information fill in page number on Inquiry Card, on page 229

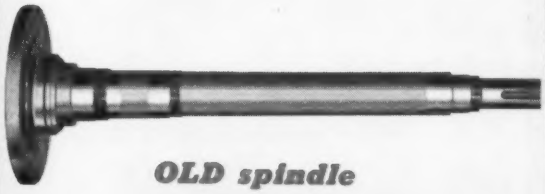
NEW 2H30 Double Spindle Grinder . . .

new spindle design improves precision—stability increased by 500%

grinds TWO parallel surfaces in ONE operation

NEW heavier spindle

500% increase in stability
at rim of 30″ disc



OLD spindle

Heavier spindle design in comparison with old spindle clearly shows why new 2H30 gives improved precision grinding. Note shorter spindle length combined with greater cross-sectional area that gives greater rigidity and stability. Send for your copy of the catalog describing this new Double Spindle grinder.

GARDNER

precision disc grinders

BELOIT, WISCONSIN

the latest word in low cost machining

televersal

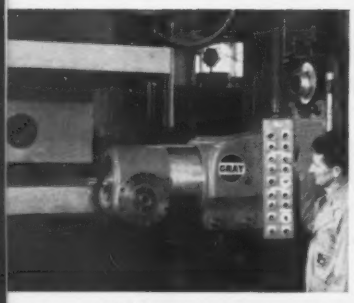
This new GRAY TELEVERSAL head tremendously increases machining range. Conveniently applied, quickly positioned, its great rigidity permits highest horsepower milling cuts.

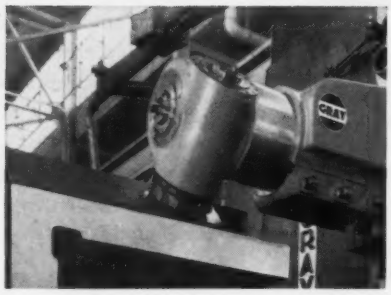
The large diameter quill may be swiveled to permit any angular cut. A triple-straddle clamp inflexibly locks the quill to the cast pyramid body.

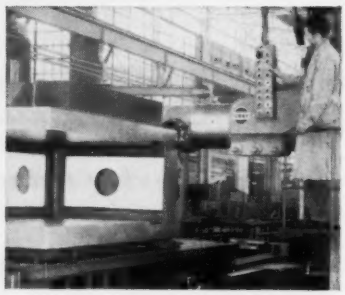
Designed to keep the job low and yet permit great machining range. Ideal when used with column cross travel of the new GRAY horizontal, boring, drilling and milling machine.

Not just an attachment, but a high power massively built, heavy milling unit that offers a new concept in versatility.

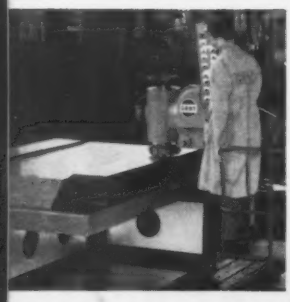
The G. A. GRAY Co., Cincinnati, Ohio

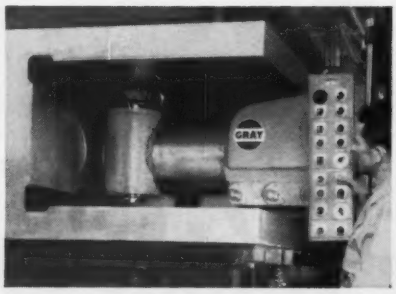


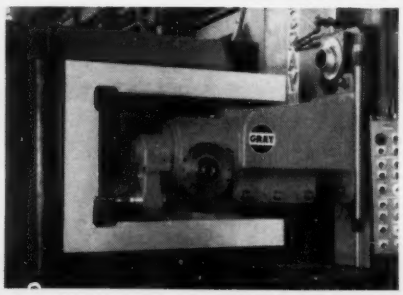


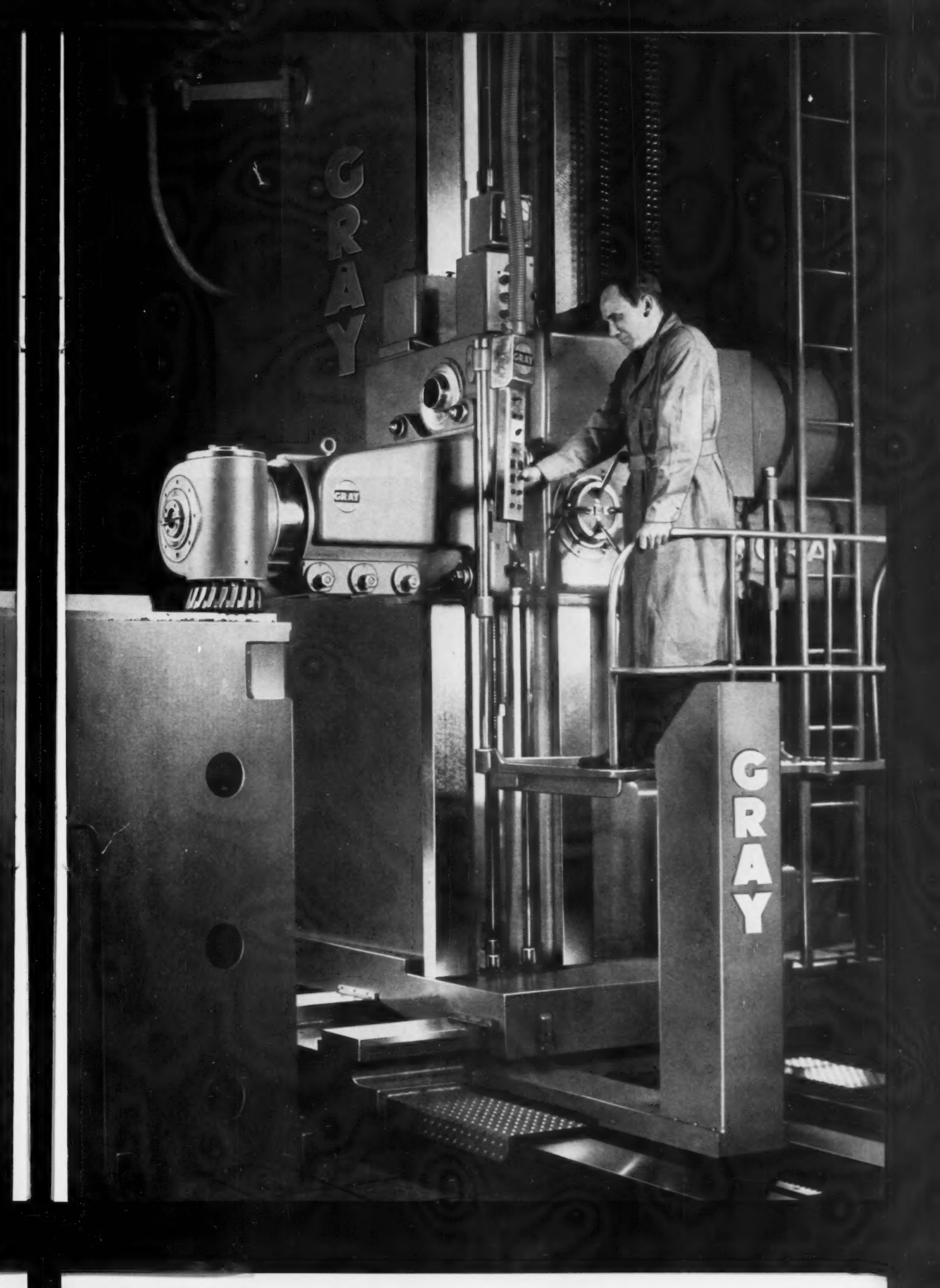


six different surfaces and more ... and only ONE work-setting








GRAY
GRAY
GRAY
GRAY

Power and rigidity of Warner & interrupted —*BOOST*

AT
R. H. LITTLE
COMPANY

Swasey 4-A easily handle severe cuts in tough steel casting

PRODUCTION 200%!

Once again, the cost-cutting combination of power, rigidity and accuracy built into all Warner & Swaseys has more than doubled production—this time up to 200% for the R. H. Little Company of Canton, Ohio.

ENCLOSURES OF SAE 1045 cast steel for diesel-electric locomotive journals, designed by The Timken Roller Bearing Company, are run in 500-piece lots at the rate of 12 to 15 daily on Little's new Warner & Swasey 4-A Extra-Heavy Duty Saddle Type Turret Lathe.

The part has ⅛ to ⅜-inch stock per side. In addition to heavy stock removal, severely-interrupted cuts put a terrific strain on both tooling and the machine. Power and rigidity of the 4-A easily handle the job. On the first operation involving combined and multiple cuts—four in all—metal removal is equivalent to 1½ inches. Three cuts—two turning and one boring—are taken from the hexagon turret combined with a facing cut from the square turret. Carbide tooling roughs the part at 250 SFM—.017 inch feed; finishing operations are at 400 SFM.

This same casting was previously machined at the rate of only 5 a day when run on a 20-year-old lathe. Production was held down due to the machine's lack of horsepower and rigidity. This caused excessive downtime for tool changing and required constant operator attention to the maintenance of longitudinal and diametrical tolerances.

When you require extreme machining accuracy, with heavy metal removal, call the Warner & Swasey Field Representative. He will discuss with you how the job can be handled most efficiently.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS ... WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

Giddings & Lewis

MODEL

350-T

precision horizontal boring, drilling and milling machine

LITERATURE AVAILABLE:
For complete specifications on Models 350-T and 340-T horizontal boring, drilling and milling machines, write for Bulletin No. 30-T.

Any large or small manufacturing plant can profitably own a G&L 30 Series table-type horizontal bar. Here's a machine that enables you to perform a variety of precision work at higher productive capacity and at lower cost than any other machine on the market.

Two popular horizontals in the 30 Series line are the Model 350-T with 5" dia. spindle (25 hp) and Model 340-T with 4" dia. spindle (20 hp). Other horizontal boring machines are offered in spindle diameters ranging from 3" to 14". . . main motor drives 10-150 hp.

For more information on G&L's complete line of horizontals and their many profit-making accessories and attachments — built-in rotary tables, electric automatic positioning device, etc. — contact your nearest G&L representative or write direct.

A Multipress case study

G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-69

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

A Multipress case study

How to automate production

Multipress® curbs costs of Dormeyer mixer parts . . . triples output by integrating three separate operations

Often, a series of operations can be combined to both improve product quality and cut production costs. This was the experience of Haber Corp. when they streamlined production of beater spindles for their Dormeyer automatic food mixers.

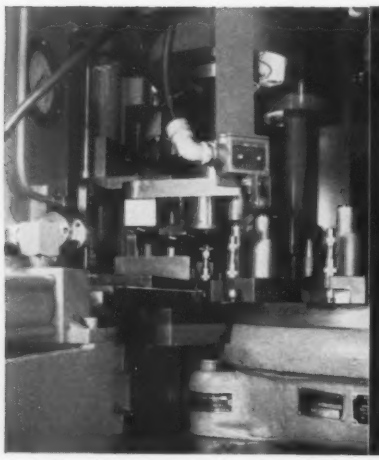
By reducing the size variations of slots cut into the spindles and thus eliminating the need for deburring, quality was boosted . . . costs cut.

A special 8-ton hydraulic Multipress was selected to combine three machining operations. Only loading parts on the 12-station hydraulic index table is performed manually. Once the cycle-start button is pressed, the parts advance step-by-step until a small flange-mounted cylinder ejects the finished beater spindles.

In separate manual operations, production rates of from 200 per hour for cutting slots to 450 per hour for deburring had been standard. With Multipress, a continuous flow of 1020 beater spindles per hour is achieved with only one operator.

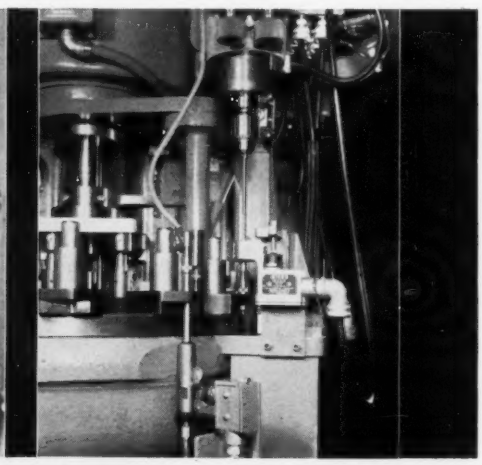
Advance cost analysis estimated that equipment and tooling would be amortized within a year due to increased production and quality. Actual production proved this estimate too conservative.

Find out how Denison hydraulic Multipress can perform a three-in-one job for your company—improving quality, speeding production and cutting costs. Write to Denison Engineering Division, American Brake Shoe Co., 1244 Dublin Road, Columbus 16, Ohio.



Ram descends to shear four slots, then holds down under full pressure as side cylinder advances broach for .050 slot. Chips are trimmed at next ram station.

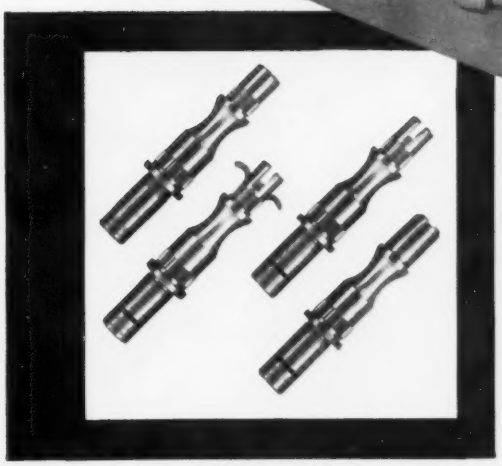
Next, spindle receives hopper-fed sleeve under transfer mechanism. Sleeve is pressed over spindle end by a cylinder activated by descending ram.



In final operation, spindle is clamped and center hole reamed through by drill head. Flange-mounted cylinder then ejects spindle from fixture.

hydraulically

8-ton hydraulic Multipress equipped with 12-station index table. Index table is mounted over special bolster on 22-inch work circle, to which is attached one-ton capacity, foot mounted hydraulic cylinder with 12-inch stroke.



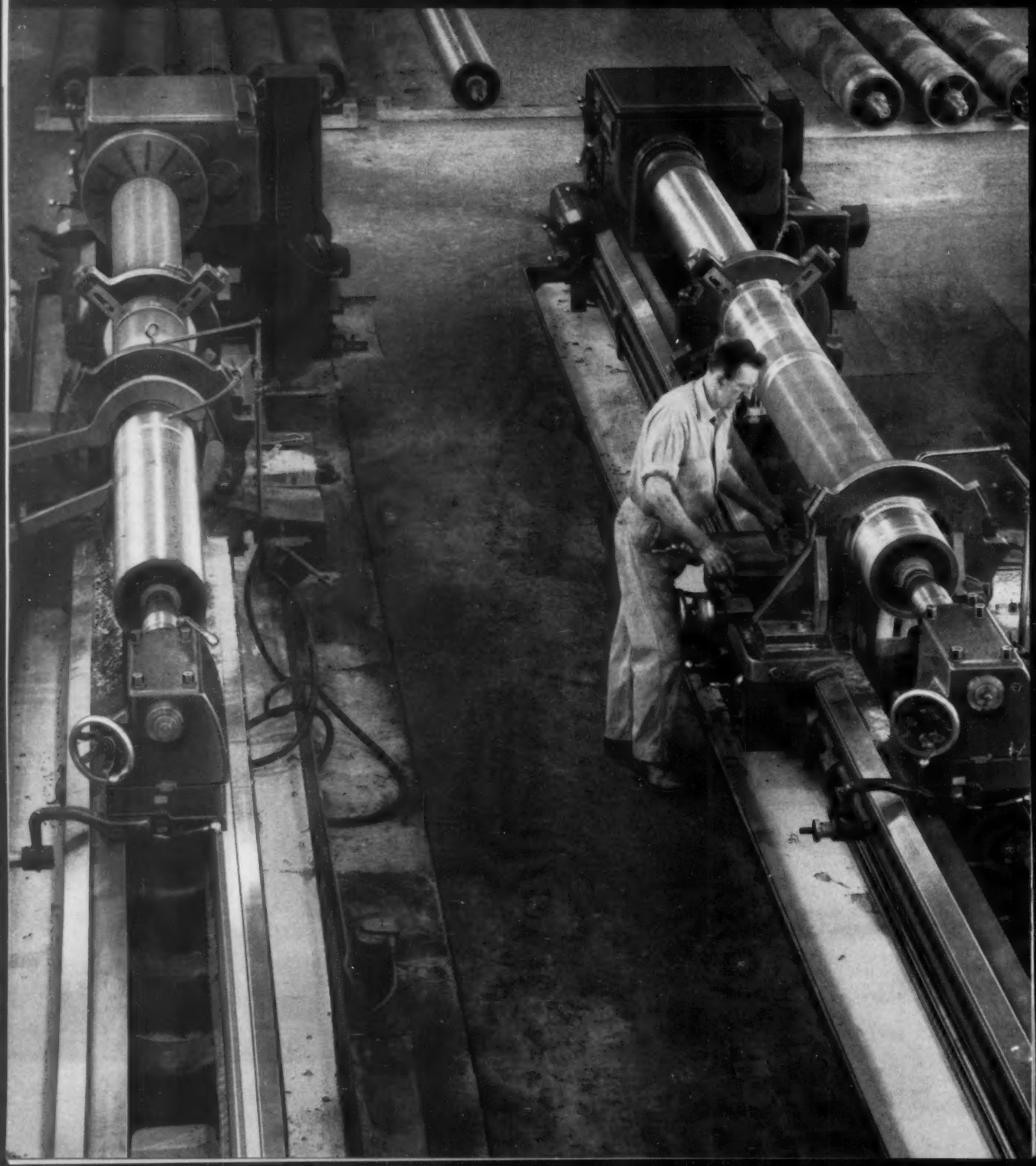
Various machining stages illustrated: (left to right) spindle prior to slotting; after shearing slots, showing chips; after trimming of slots; with sleeve pressed into place.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

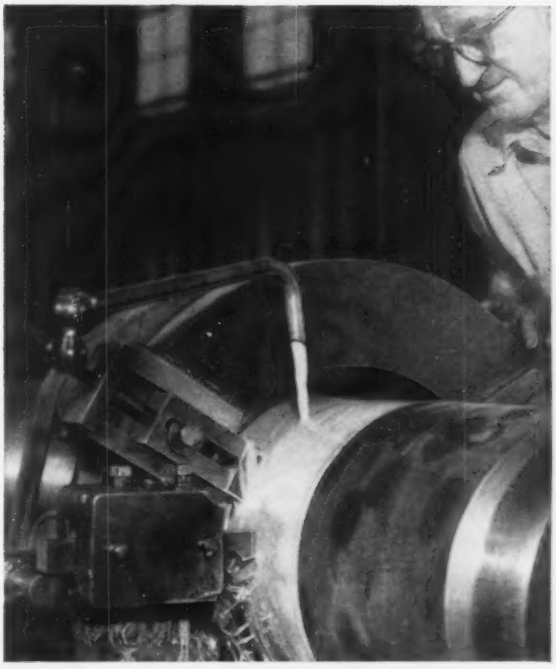
DENISON HydrOILics

Beloit Eastern needed LeBlond

Two of the eight LeBlond 25" and 32" Heavy Duty Engine Lathes in Beloit Eastern's new pipe roll shop.



rigidity for this 3 in 1 turning idea



Finishing tool is mounted on back of special follow rest.

LeBlond lathe owners often tell us about unusual ways they are able to use our machines. There's a reason. The rigidity, accuracy, weight—the unique features of LeBlond lathes encourage owners to expect a little more of them. With LeBlonds they confidently develop turning techniques that they just couldn't expect an ordinary lathe to handle.

Take this pipe roll "skinning" job at Beloit Eastern Corporation, Downingtown, Pa. These 23′ extruded wrought steel pipe rolls must mate perfectly in high-speed paper making machinery. This calls for straight and true machining accurate to .002 end to end—in itself, a stringent test of lathe rigidity.

But Beloit Eastern had to "skin" costs, too. So they took advantage of LeBlond's unique tailstock design with their unusual 3 in 1 turning idea. Now rolls are roughed, finished and polished all in *one* operation:

1. **ROUGHING**—Carbide tool is mounted on the compound.
2. **FINISHING**—A special solid ring-type follow rest (bolted to the carriage wings) carries a tool block and high-speed finishing tool.
3. **POLISHING**—A wooden emery paper holder made like a clamp is tied together against the turning pressure of the roll.

Spindle rigidity of the LeBlond tailstock, when greatly extended, actually makes this cost-saving method possible, since room must be made for follow rest at beginning of cut. The tailstock spindle even when extended, has full-length support thanks to exclusive LeBlond Thrust Lock design.

Ask any LeBlond lathe owner. He'll tell you he likes LeBlonds because he can count on them—for more rigidity, more usable power, more years of dependable, accurate turning. After all, isn't that what *you* want in a lathe? Today, get all the details on the complete LeBlond line of heavy duty turning machines, the most dependable lathes in the world. Call your LeBlond Distributor or write. *Ask for Bulletins HD-156 (25″) and HD-165 (32″).*

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

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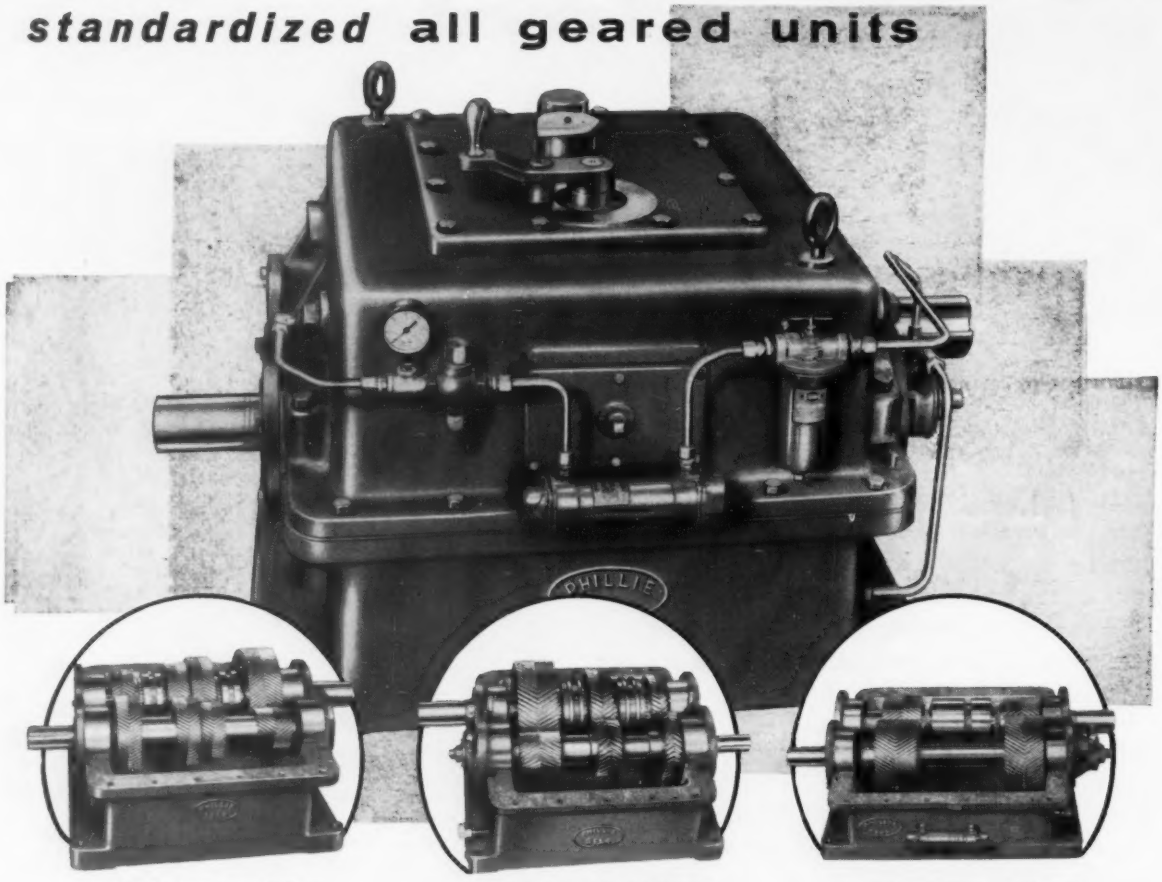

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MASTERLINE GISHOLT

CUT MACHINING TIME WITH

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

ELECTRIC CYCLE SELECTOR CUTS CHANGE-OVER FOR MARLIN-ROCKWELL CORP.

Three different cycle patterns available for machining bearing races

This smart setup on the Gisholt MASTERLINE No. 12 Automatic Production Lathe may give you some cost-cutting ideas. Marlin-Rockwell Corp., Jamestown, N.Y., is using it to machine 9 different sizes of steel inner and outer bearing race forgings in record time.

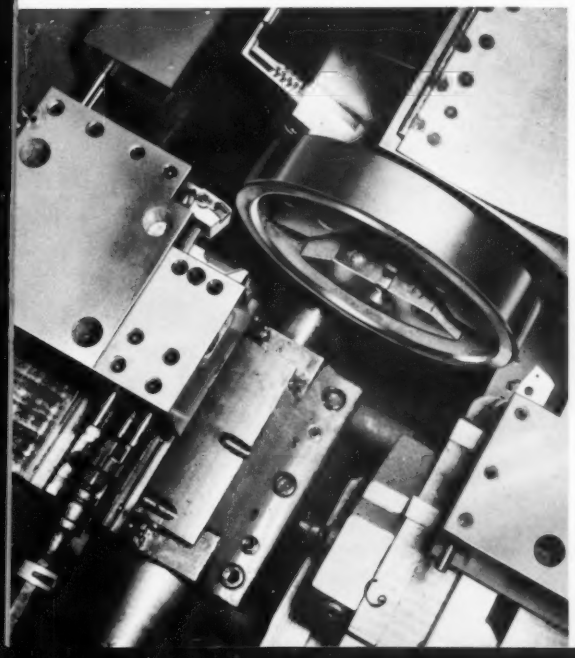
All workpiece sizes are handled within 3 basic cycle patterns (shown in diagrams) for the front carriage. In setting up for each part, the operator simply selects the correct cycle from a 3-position switch on the starter box at the rear of the machine.

Cycle No. 1 is for outer bearing races. A typical setup is shown below. Work is chucked in the I.D. Front carriage tools traverse, feed longitudinally to turn and form the O.D. chamfer, and cross-feed to chamfer the I.D., while a tool on the rear independent slide faces the part. Both the carriage and slide reverse-traverse to starting position, completing the cycle. Floor-to-floor time for all sizes: only 1.7 minutes.

Cycle No. 2 is for inner bearing races. Work is chucked on the O.D. Front carriage tools bore and form the I.D. and cross-feed to relieve the boring tool, while the part is faced from the rear slide. Both reverse-traverse to starting position to end the cycle. Three part sizes are handled in 1.6 min. f.t.f. One smaller size is completed in 1.0 min., including facing and forming the O.D. edge from the rear independent slide.

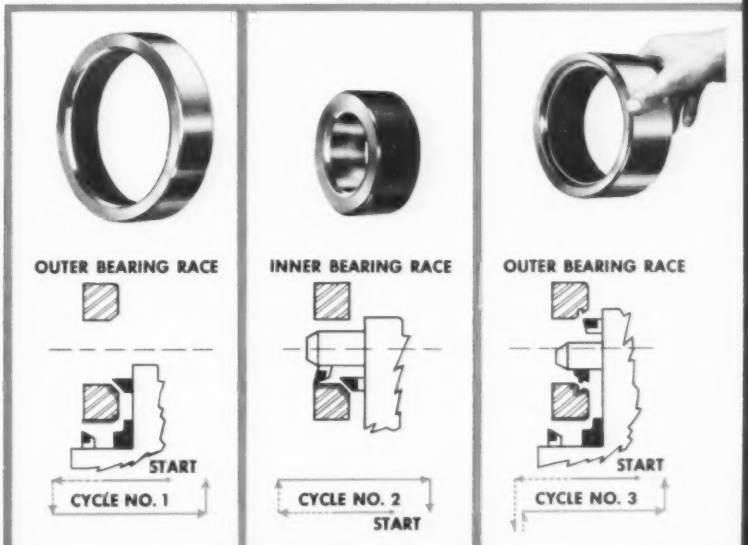
Cycle No. 3 is used on one type of outer bearing race. Chucked in the I.D., front carriage tools turn and form the O.D. chamfer, rough cobore the I.D., cross-feed to form a snap ring groove and reverse-feed to clear the form tool. Again, facing is from the rear slide. Reverse-traverse to starting position completes the cycle. F.t.f. time: 1.5 min.

Simple selector switch cuts downtime by making 3 basic operating cycles instantly available. Different chuck jaws are required for inner and outer races. Jaw inserts handle diameter changes. Minor tool and stop adjustments permit completion of change-over in record time.



Tooling for cycle No. 1. Note swivel-jaw which minimizes distortion and centralizes part.

Three different part types handled are shown after first machining operations.



THE NEW GISHOLT MASTERLINE

MASTERLINE GISHOLT SINCE 1887

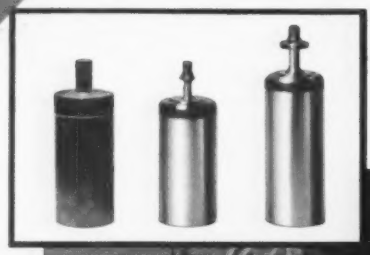
CUT MACHINING TIME WITH

HOW MACHLETT LAB. MACHINES TRI-METALLIC PARTS

Speeds operations, assures accuracy with "tenth" indicators on adjustable slide tools

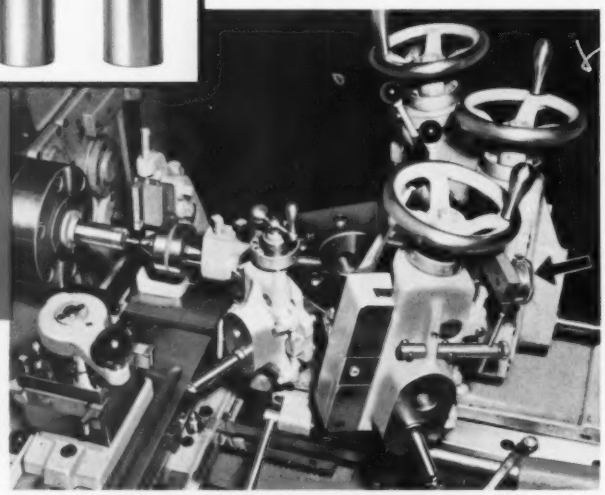
TIME-SAVING IDEAS

Two different workpieces handled. Largest is 4¾" long; smallest is 3½". Both are 1½" in diameter.



This well-planned operation rates close study.

Machining DX anode assemblies, Machlett Laboratories, Springdale, Conn., is getting close tolerances and fine finishes with the new Gisholt No. 3 MASTERLINE Ram Type Turret Lathe—handling easily distorted copper tubing in the body, a steel insert shoulder and head, and a threaded end of molybdenum.



Tooling for finish-machining shows threading operation. Note the "tenth" indicator on the adjustable slide tool.

Three operations complete each workpiece. For the first, the part is chucked in the I.D. on an air-operated expanding mandrel and the O.D. is rough-machined. A live center supports at the end while tools on the square turret and rear tool post face and form.

Turned end-for-end for the second operation, the part is held in an air-operated collet chuck on the previously machined O.D. Hex turret tools rough- and finish-bore the copper body and co-bore the steel insert at the far end. For finish boring, "tenth" indicators are mounted on the adjustable slide tools to hold tolerances of .0005" in the co-bore and .001" in the body.

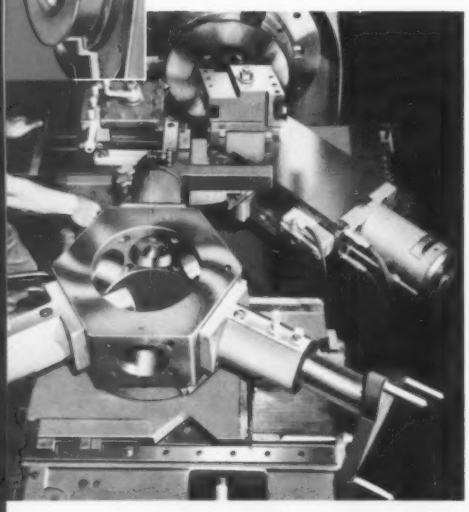
For the third operation (shown in illustration), the piece is again chucked in the bore on the mandrel and all O.D. surfaces are finish-machined, threading the molybdenum insert end from the hexagon turret with a self-opening die head and turret-threading attachment.

Tooling remains intact for all 3 operations. Concentricity is held within .001" between I.D. and O.D. over length of part. F.t.f. times: 3.10 min. for first operation; 4.65 for second; 3.10 for third.

A Preventive Maintenance Chart is now available for both Ram Type Turret Lathes and Saddle Type Turret Lathes. Write Gisholt for copy.

CARRIER CORPORATION CUTS TOTAL TIME 50% ON IMPELLER WHEELS

Uses JETracer on 3L to contour-face 66 different part sizes



You, too, may be able to use a setup like this one at Carrier Corporation, Machine & Systems Division, Syracuse, N. Y. Here, the modern JETracer—on the bridge type cross slide on a standard 3L Saddle Type Turret Lathe—improves machining of 37 different sizes of steel impeller hubs, 29 different sizes of mating covers, and repair parts for impeller wheels used in the manufacturer's well-known centrifugal compressors.

Eight separate operations, 4 in each face, are used for the 21"-diam. part shown at left. Alternating machining between faces cleans up any stress distortions and assures concentricity and parallelism between the contoured surfaces.

The part is gripped on the O.D. by a special fixture (mounted on a 24", air-operated 3-jaw chuck) to machine one side, and held in the bore by an air-operated expanding mandrel to machine the other side. Before each chucking, a turret-mounted pusher forces the work on a support ring against a vibration dampener.

Straight boring is handled from the hex turret, which also carries a special turret-mounted template carrier to govern movement of the JETracer. Tools on the cross-slide square turret turn, rough-face and chamfer—and the JETracer rough- and finish-machines the contoured face. A variable-speed motor drive assures constant surface cutting speed to meet surface finish requirements.

Tooling used to finish-machine impeller cover. Note turret-mounted template carrier in center. Inset shows finished part on special fixture mounted on chuck.

Total floor-to-floor time for all 8 operations is only 46.25 minutes, replacing several different machines formerly used. Total machining time was cut 67%. Tolerances are held to ± .001" on the bore and ± .005" on thickness.

GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

GISHOLT

TIME-SAVING IDEAS

HOW WALWORTH SIMPLIFIES CLOSE-TOLERANCE TAPER BORING

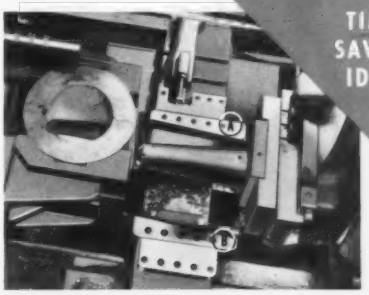
Special cams on front and rear cross slides guide taper-boring slide tool

You may see ways to cut costs in your own operations by checking this set-up. With it, the Walworth Company, Inc., Kewanee Works, Kewanee, Ill., gets accuracy and fine finish on 11 different sizes of cast iron and cast steel plug valve bodies. The machine used is the Gisholt Fastermatic Automatic Turret Lathe.

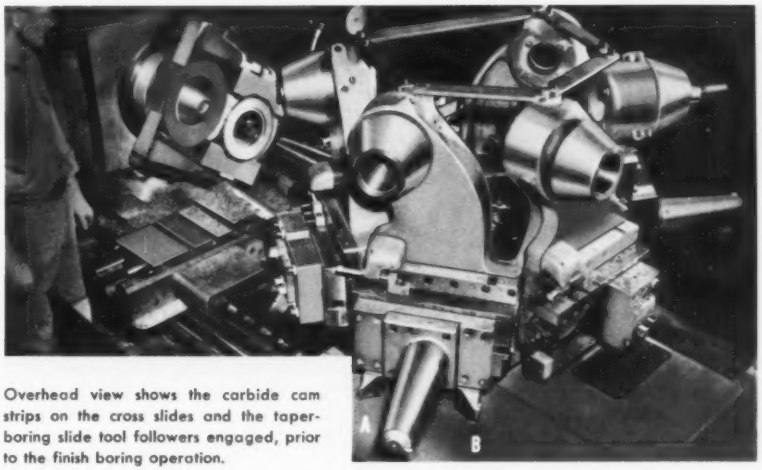
Workpieces are held in a hand-operated 2-jaw chuck. A turret-mounted carrier bar simplifies loading, moving the rough workpiece into the chucking fixture and locating it accurately for length before chucking. Rough- and finish-taper boring, counter-boring, grooving, facing and sizing operations are handled by hexagon turret tools.

An unusual camming arrangement assures accurate machining and fine finishing of the taper bore and counter-bore. Here's how it works: Carbide-tipped followers (A and B), on both sides of the taper-boring slide tool, move between special plates, with solid carbide cam strips, mounted on the front and rear cross slides. Air-operated follow-up from the rear cross slide forces the taper-boring slide tool to follow the cam on the stationary front cross slide, generating the required taper in the plug valve bore. Results: extreme taper accuracy and uniform fine finish, so essential for long service life.

Eleven different parts are handled, with f.t.f. times ranging from 9.4 min. on smallest 2″ plug valve body, to 22.8 min. on largest 6″ body shown in illustration. Special taper cam eliminates human error, provides finer finish.



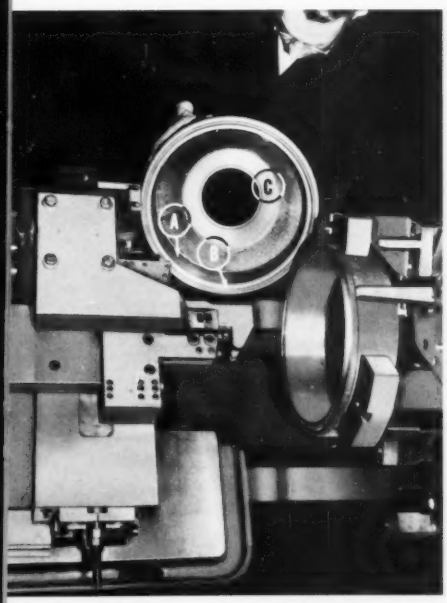
Fixture, workpiece and tooling for 6″ flanged plug valve body. Note carbide-tipped cam followers A and B on taper-boring slide tool.



Overhead view shows the carbide cam strips on the cross slides and the taper-boring slide tool followers engaged, prior to the finish boring operation.

MACHINES BRAKE DRUMS FRONT AND BACK IN SINGLE CHUCKING

Well-planned setup handles 13 surfaces, including straddle-facing and boring



Overhead view shows platen table back for loading and unloading. Note straddle-facing and boring tool arrangement.

In looking over this tooling setup on the Gisholt Simplimatic, you may spot ideas on low-cost machining of parts like these cast iron brake drums. Four different sizes are handled, with minimum tooling change-over and adjustment between sizes.

Here's how the 19″-diam. drum is machined, holding work in a 24″, 3-jaw air chuck. Using extended jaws plus operating the Simplimatic table 12″ back of standard position gives the straddle-facing tools ample clearance. Wide swivel jaws centralize the part and minimize distortion. A positive stop locates the work from the back side of the rim.

The front slide mounts a cam-operated auxiliary slide which engages the 2 tools that bore the large I.D. (A), reducing machining time by dividing the cut. Other tools on this slide chamfer the I.D. edge and turn the rim (B). A special tool block holder on top of the front slide carries additional tooling to rough- and finish-bore the web (C). As the platen table moves into operating position, tools on the rear independent slide protrude through the bore. Standard slide movement lets the tools straddle-face, chamfer and co-bore the web (C), and at the same time finish-face and form the rim (B) to complete the part.

The Simplimatic—ideal for jobs like this—holds f.t.f. time on this part to 4.2 min. Wide platen table permits positioning of slides and tooling to machine more surfaces in less time. Automatic cycle frees operator for additional machines or other work.

MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

HERE'S HOW TRANE COMPANY BALANCES 45 DIFFERENT BLOWER FANS

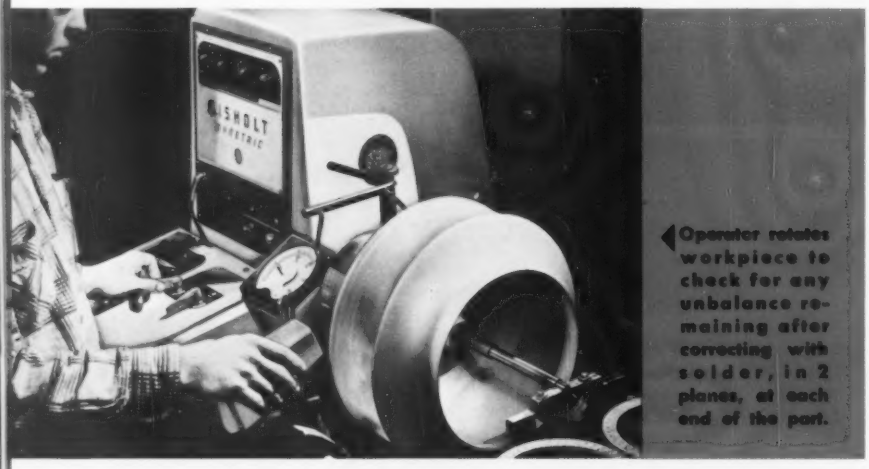
Smart tooling assures accuracy by minimizing parasitic weight

If your production setup includes balancing of rotating parts, you'll want to read how The Trane Company of La Crosse, Wis., uses the Gisholt 1S DYNETRIC Balancer on a wide variety of similar parts—with minimum change-over.

Here, the 1S handles 45 different types of single- and double-width blower fan wheels used in air conditioning, ventilating and special industrial process systems. Although weights and sizes of the fans fall within the 1S range, in some instances the weight of a standard arbor used for support equals or exceeds the weight of the part.

Here's how the effects of this parasitic weight are minimized: Fan wheels are divided into two groups, one with bore diameters less than 1" and the other 1" or larger. In each group, the widest fan determines the length of arbor used for that entire group. The arbors have small bearing diameters and a larger center diameter with a shoulder and key. A keyed bushing is pressed onto the arbor. Parasitic weight is minimized by slots milled through the bushing, leaving 6 lands 3/8" wide to support, locate and drive in the hub of the fan wheel to be balanced.

Unbalance is located and measured in 2 planes, and corrected by adding solder on the outer shroud rings. The fan is rotated again to inspect for balance, completing the operation.

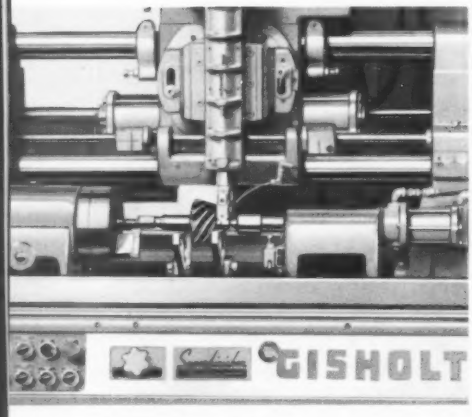


Operator rotates workpiece to check for any unbalance remaining after correcting with solder, in 2 planes, at each end of the part.

A large variety of similar parts is handled with minimum change-over through well-planned tooling. The 1S handles all production, assuring quiet, vibration-free operation of high-speed, lightweight parts.

THIS SETUP SUPERFINISHES 120 PINION GEARS AN HOUR

Eliminates operator fatigue with loading rails, air-operated tailstock



Workpiece shown held between centers ready for Superfinishing operation. Note loading rail, faceplate driver and air-operated tailstock.

Want convincing evidence of what Superfinishing can do to lower costs and improve quality?

This manufacturer is completing bearing surfaces, on 8 different sizes of steel rear drive pinion gears, at a rate of 120 parts per hour at 80% efficiency—using a Gisholt 51A Superfinisher. Here is peak production—attained by using a standard machine with a simple set of loading rails, plus an air-operated tailstock to pick up the workpiece prior to the Superfinishing operation.

Here's how it works: The operator moves each part to the loading rail, where it rolls by gravity and stops automatically in line with the tailstock center. A faceplate driver catches the splines on the workpiece, and movement of the tailstock center lifts the part from the loading rail to clear the work during the automatic Superfinishing cycle. The surface finish is reduced from 20 to 30 down to 5 to 7 micro-inches R.M.S. or less, in just 25 seconds f.t.f. time.

Eight different workpiece sizes are Superfinished with minimum change-over. Superfinishing provides extremely smooth surface finish in less time, and exposes true base metal for long surface life which promotes trouble-free operation.

No. 5-657 681

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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This Time Payment Plan enables purchase of new machjnes on extended terms. Simplicity is the keynote. Upon a down payment of 25% of the original purchase price, terms may be extended up to a maximum of five years, at an interest charge of 3¼% per year. Payments are equal and quarterly, starting 60 days after delivery. In the event that you wish to pay off the entire balance at any time, a discount approximately equal to the unearned interest will be allowed.

THE NORTON LEASE PROGRAM

This Program includes three tested plans for leasing new Norton grinding or lapping machines. Each plan offers you the option of terminating the lease or purchasing the equipment after a stated period. Particular advantages of the Lease Program are: (1) You can acquire needed machines for just the period in which you can use them profitably, thus eliminating the obsolescence factor; (2) You can make a thorough trial of equipment without going to the expense of actual purchase, unless you decide to do so later.

A Wide Choice of Machines

Norton machines available under the Purchase Financing Plan and Lease Program include a broad selection of the most popular types of grinders and lappers. Special arrangements will be considered whenever other Norton machines are required.

For Further Information

see your Norton Representative. He will be glad to discuss the relative merits of each Norton financing method, with regard to your particular requirements. He will also give you complete details of the various machines available and advise you as to which are best suited to your production needs. Or you can write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

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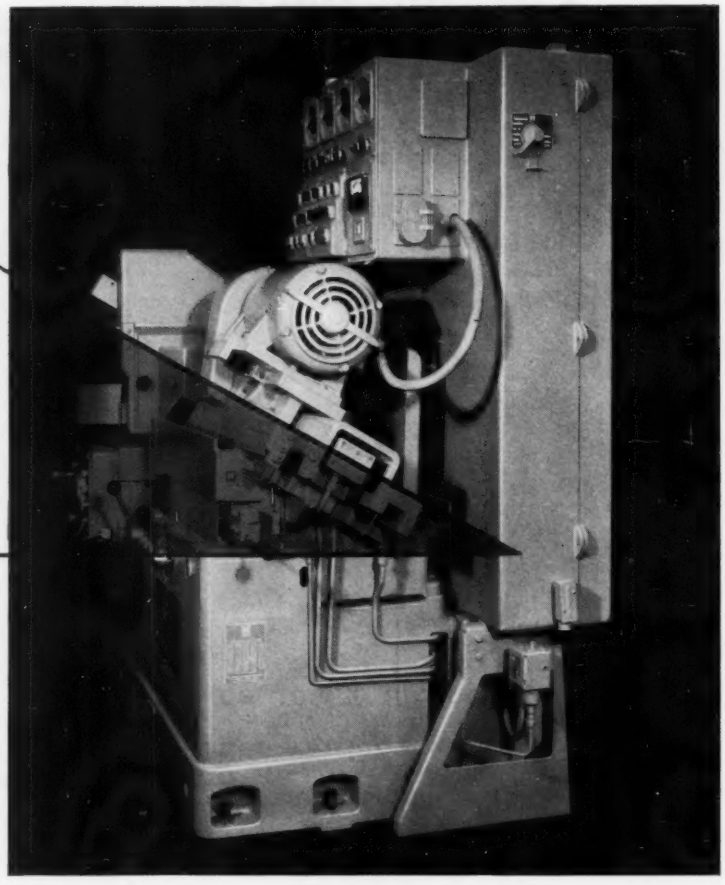
New RITE-ANGLE CENTRI-MATIC

cuts grinding time as much as 50%



A NEW ANGLE in internal grinding gives greater strength and rigidity for faster stock removal, with highest accuracy and precision

The Heald RITE-ANGLE Centri-Matic represents the latest and most advanced design in the field of high-precision internal grinding. It includes all the basic advantages of other Heald internals — plus the added feature of substantially increased production rates. Mounting the wheelhead table at a 30° angle provides greater strength and stability and permits much faster stock removal.

Production economies due to faster grinding cycles are improved in all sizes of work handled on this equipment, but are most apparent in the larger (up to 4½" O. D.) sizes, where grinding time can be reduced as much as 50%.

This new RITE-ANGLE design is now available in the Model 190A Centri-Matic for straight and taper bores, and the Model 1901A Centri-Matic ball track grinder — both machines providing a new high in production, with maximum accuracy and precision, for work up to 4½" O. D. Ask your Heald representative for complete information or send for a copy of new RITE-ANGLE Bulletin.

OTHER ADVANTAGES

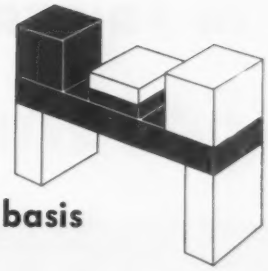
- Choice of Hi-Frequency or Belt-Driven Wheelheads
- Vee-Way Accuracy of Alignment with hardened and ground box-type table ways
- More Efficient Swarf and Coolant Disposal
- Infinitely Variable Hydraulic Cycles
- Automatic Feed Control with Self-Adjusting Diamond

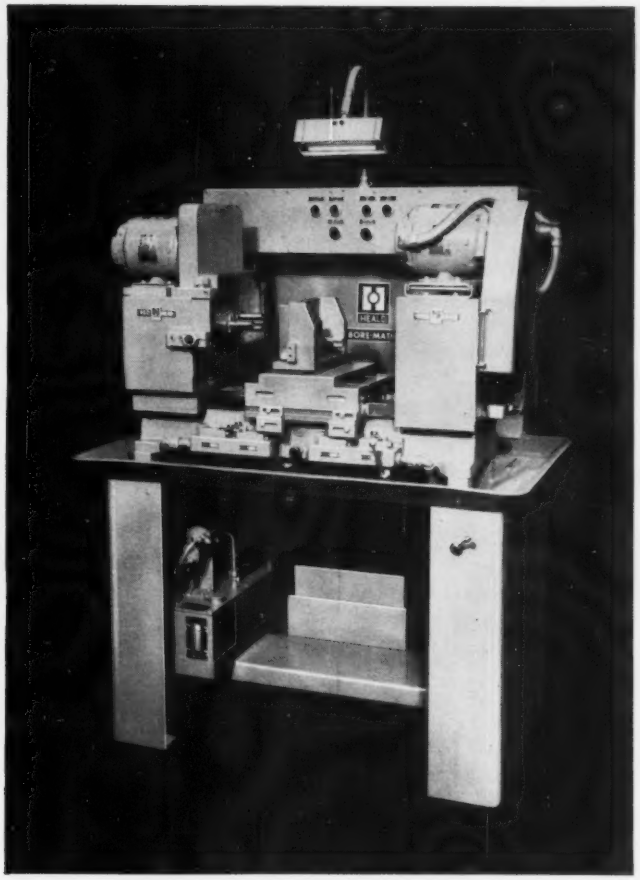
IT PAYS TO COME TO HEALD!

HEALD®

New UNIT-TYPE BORE-MATIC puts

custom-built machine design on an "off-the-shelf" basis





. . . offers complete flexibility for meeting virtually all small-work Borizing requirements from a STANDARD LINE

Here, for the first time, is a small, compact Bore-Matic that gives you complete flexibility of design. Its unique "building block" arrangement, with standard interchangeable head units and accessories, provide's practically unlimited versatility for meeting all of your small-work Borizing requirements with minimum machine investment.

Basically, the Model O Bore-Matic consists of a precision-built table way unit with hardened and ground box-type ways, hydraulically operated table, hydraulic power unit and all necessary controls. A variety of boringhead units, complete with motor drive, can be interchangeably mounted on the table ways at either or both ends of the machine with precise alignment.

This Model O unit is built to the same standards of accuracy and precision as any other Heald Bore-Matic. It will easily hold tolerances of .0002 on regular production work and is capable of the same type of Borizing operations as a larger Bore-Matic. Ask your Heald representative for complete information, or send for a copy of new Model O Bulletin.

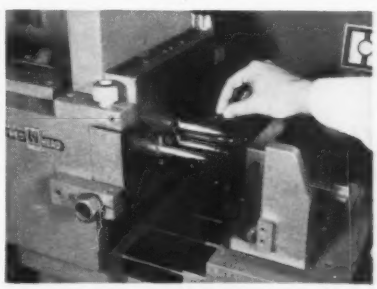
THESE STANDARD UNITS CAN BE USED IN ANY DESIRED COMBINATION

- Boringhead and Drive Unit for one or two standard Red Heads
- Multi-Spindle Boringhead and Drive Unit
- Swivel Boringhead and Drive Unit for one standard Red Head
- Hydraulic Cross Feed Units for standard or miniature heads
- Hydraulic or Manual Cross Slide
- Coolant Pump and Tank Unit
- Vertical Indexing Work Slide

NEW MULTI-SPINDLE BORINGHEAD

permits simultaneous multiple-hole Borizing on close centers

A Multi-Spindle boringhead assembly consists of any practical number and arrangement of miniature precision Red Heads, mounted in interchangeable spindle plates that are jig bored to the exact requirements of each job. Heads can be spaced as close as ¾" on centers and all holes are Borized simultaneously.



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Worcester 6, Massachusetts

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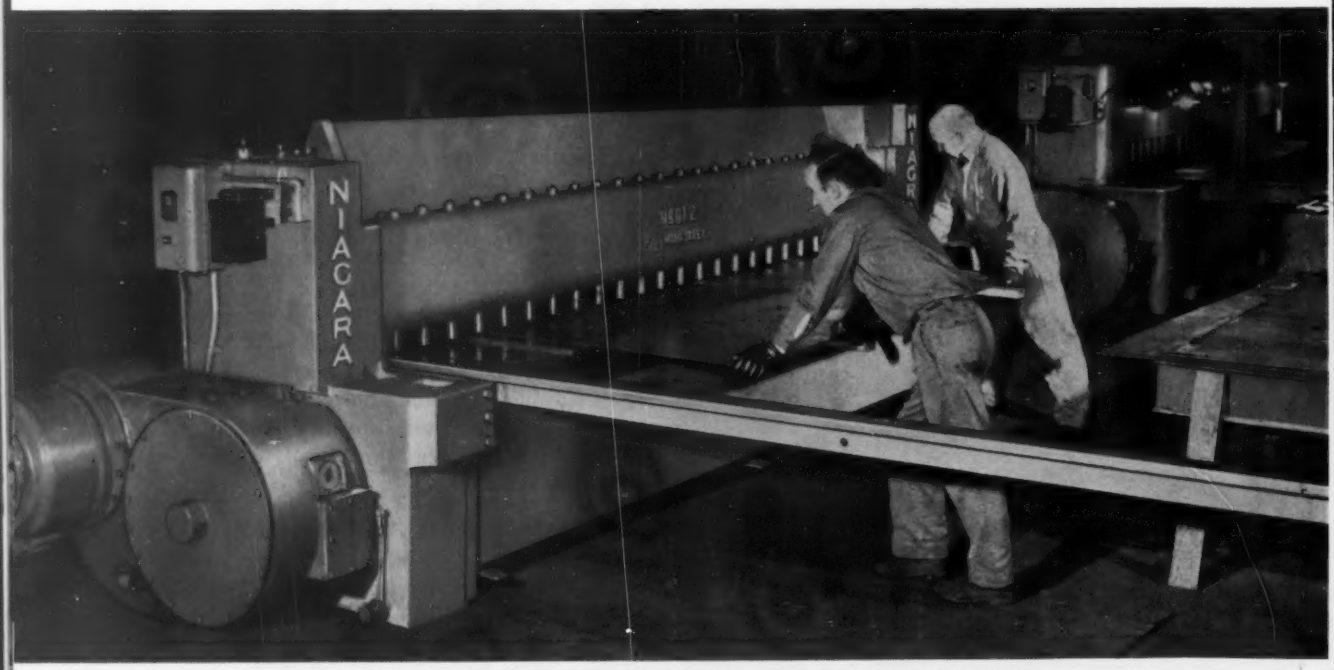
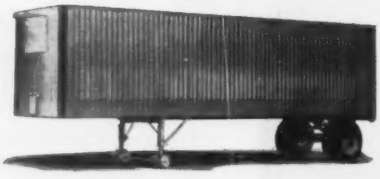
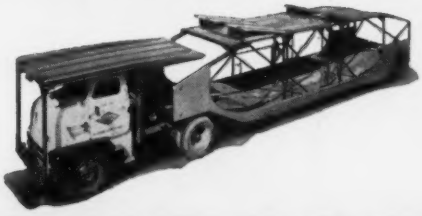
IN POWER SQUARING SHEARS...

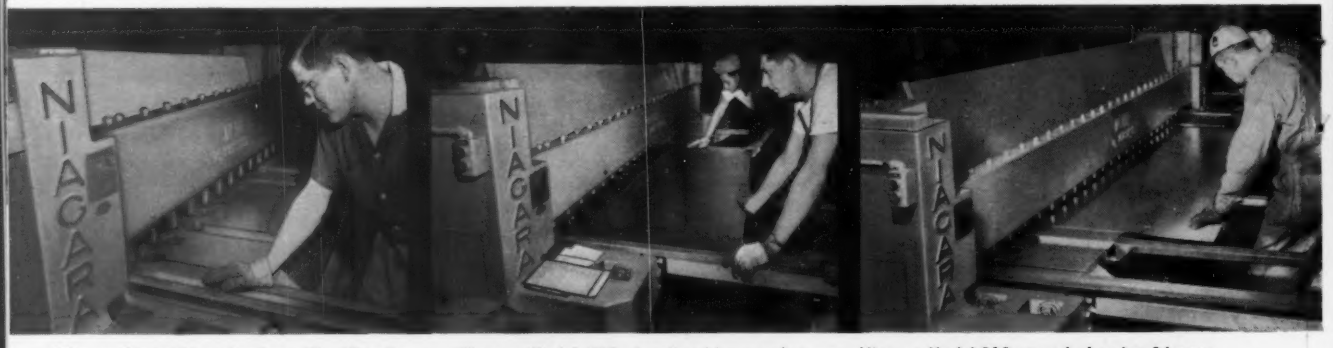
Fruehauf picks Niagara for



Niagara Model 912 shearing 18" x 30" transition plates from 10 gage hot-rolled steel for tank trailer frames.







Niagara Model 96 cutting forty 4" x 6" trailer gussets per minute from ⅜" and ½" bar stock.

Niagara Model 812 shearing 11 gage hot-rolled steel to 36" x 144" for trailer floor beams.

Niagara Model 812 at work shearing 24 gage stainless steel to 4' x 6'6" for van trailer door panels. Production: 2.7 pieces sheared all 4 sides per minute.

NIAGARA power squaring shears

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

"exceptional machine value"

World's largest trailer manufacturer spells out its reasons for using Niagara Underdrive Shears in producing a wide variety of parts from cold-rolled and hot-rolled steels, stainless and aluminum

As a metal fabricator, Fruehauf Trailer Company is well-qualified to speak. It not only manufactures every conceivable type of commercial trailer, but "builds more of them than any company in the world."

So, when it comes to power squaring shears, Fruehauf is particularly qualified to speak. Using several Niagara Models, it considers them an "exceptional machine value."

Enlarging on the point, Fruehauf engineers say, "Niagara Shears are capable of holding straight lines within thousandths of an inch . . . they keep their settings . . . trouble-free, they require a minimum of maintenance.

"They're well-balanced . . . can be moved about . . . require no special concrete base. We especially like their minimum height . . . can see over them. It's unlikely that an operator will step out from the shear in the path of a fork lift."

Like Fruehauf, progressive companies everywhere look to Niagara for exceptional machine value in a power squaring shear. Here are a few of the reasons:

TAKE ACCURACY! Niagara's positive, power actuated, self-compensating holddown grips work securely. Fully closed box section construction of bed, crosshead, holddown and housings resists all stresses with minimum deflection.

TAKE SPEED! More working strokes per minute and instant engagement of Niagara's exclusive multi-point sleeve clutch assure more cuts per hour. Full visibility of the cutting line, ease of operation, quick setting gages and safety features boost hourly output.

TAKE MAINTENANCE! Niagara Shears are built to stand the gaff on the toughest jobs. Simplicity of design involving a minimum number of parts, and utmost accessibility cut out costly maintenance.

Any way you look at it, Niagara has the most to offer you in modern shear performance.

NIAGARA'S NEW, FACT-FILLED BULLETIN WILL GIVE YOU THE FULL STORY

74 Pages — 141 Illustrations . . . Most Comprehensive Shear Bulletin Ever Published . . . 19 Photo Reports of Niagara Shears In Action . . . 44 Revealing Views of Niagara Shear Features . . . Easy-to-read Specs For America's Most Complete Underdrive Line (59 Models, Capacities: 16 gage to 1", Cutting Lengths: 4' to 20')

CLIP THIS COUPON FOR YOUR COPY TODAY!

see what America's most modern power squaring shears can do for you

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

MAIL your new Underdrive Squaring Shear Bulletin 69G to us immediately.

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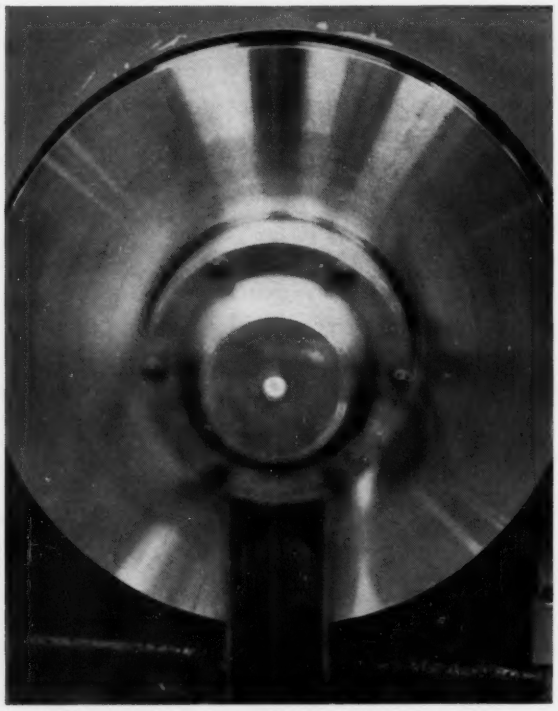
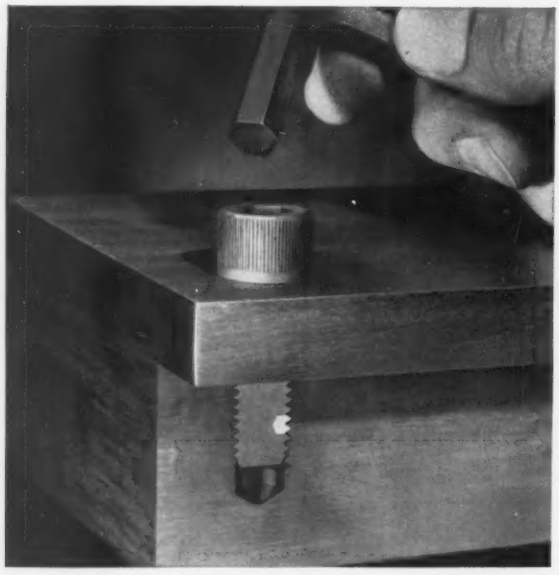


Self-locking UNBRAKO socket screws keep critical adjustments secure in the eccentric drive mechanism of this fatigue testing machine. Drive system delivers varying loads up to 15,000 pounds force to equipment under test at 1050 cycles per minute.

Vibration won't loosen Self-locking UNBRAKO socket cap screws

Screws with Nylok* device permit adjustments, keep precise settings during long test runs



HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together, and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok self-locking device stay tight under constant vibration.

Take the eccentric drive system in the fatigue testing machine illustrated above, for example. This machine must frequently run for periods up to 2 weeks or longer, day and night, to complete a single test. Loosening of the screws which are used to adjust the tension-setting mechanism could not only cause damage to the machine, but also make the test data worthless. Self-locking UNBRAKO socket head cap screws eliminate such problems.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or pounding, or endless running of a machine, won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives complete catalog and technical data on the entire line of UNBRAKO socket screws with the Nylok self-locking device. Or see your authorized industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

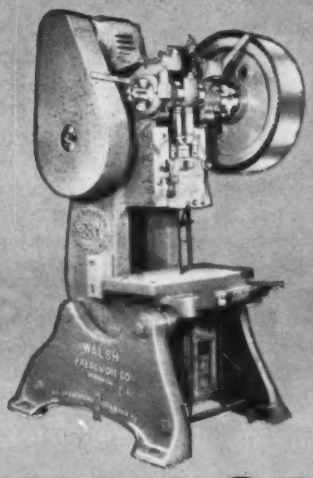
UNBRAKO® SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off. The Nylok Corporation



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Some made in 1907 with rugged dependability are *still* operating at a profit.
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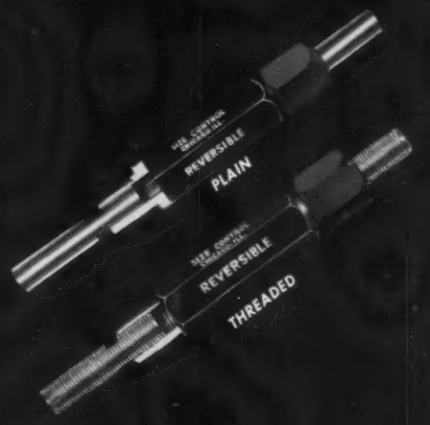

SIZE CONTROL REVERSIBLE GAGES

. . . give you 5 or more gages for the price of one—*reversible* and extra length for new gaging surfaces at no additional cost.
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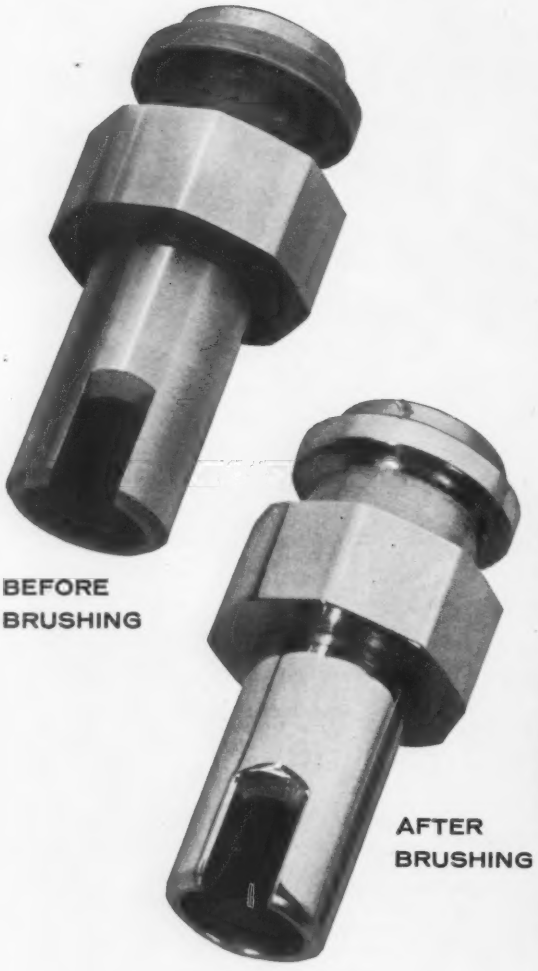
OSBORN BRUSHING METHODS *worthy of your confidence*

6-second finish



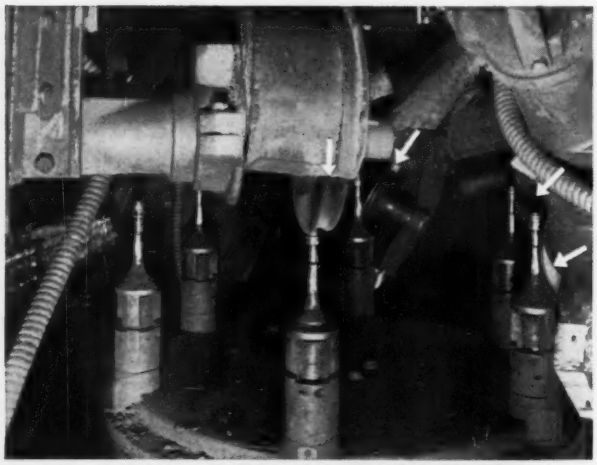
BEFORE BRUSHING

AFTER BRUSHING

THE efficient job performance demanded of these cylindrical steel cams requires the proper finishing of their many surfaces. Power brushing proved to be the most effective method for removing the sharp edges and small burrs.

In the operation shown below, Osborn Power Brushes mounted on an automatic rotary machine remove minute burrs and blend surface junctures. This is done on a 6-second cycle . . . quickly, accurately and economically.

An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, may point the way for improvements in your operations. Write *The Osborn Manufacturing Company, Dept. D-35, Cleveland 14, Ohio.*



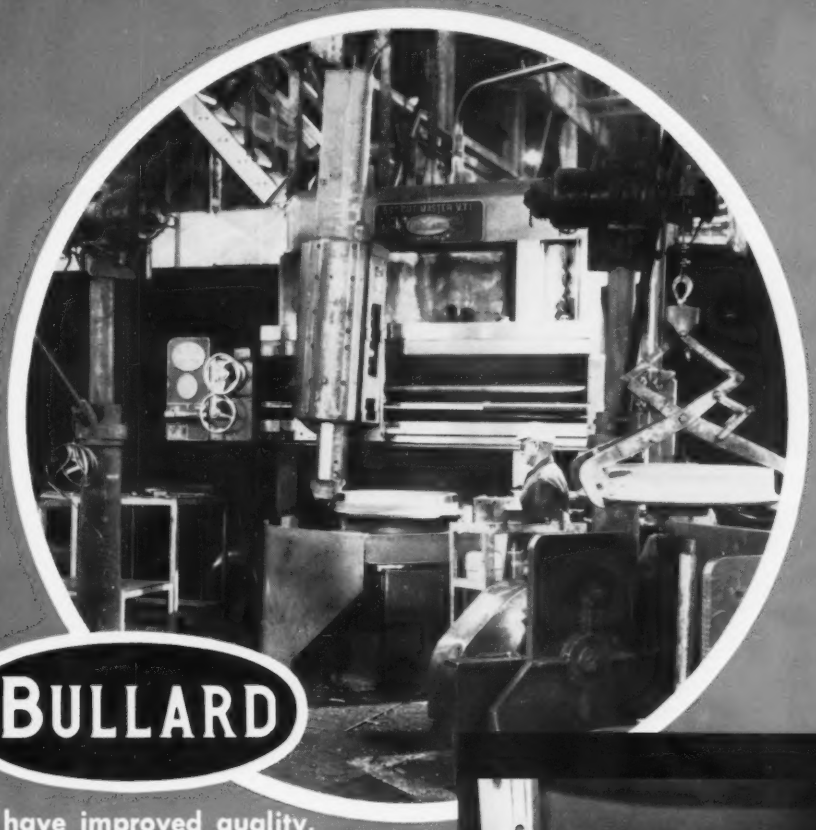
Four Osborn Monitor® Brushes remove burrs and produce accurately finished parts.

Write TODAY for the new 100-page Osborn Catalog 210-C

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information fill in page number on Inquiry Card, on page 229



BULLARD

"We have improved quality, quantity and appearance of our product with . . .

BULLARD MAN-AU-TROL
MODEL 75"

This has been accomplished by one of the nation's largest manufacturers of railroad car wheels.

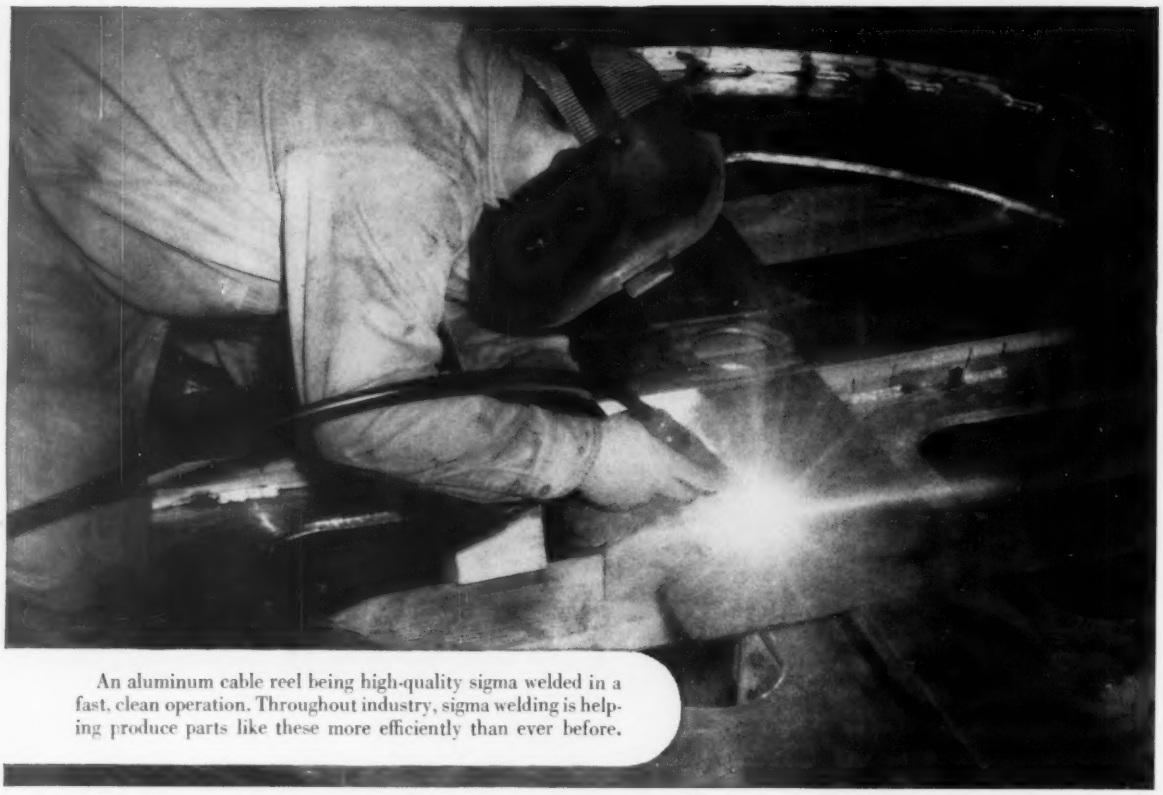
The plant superintendent tells us "that improved quality is obtained through greater machining accuracy – that quantity is improved with Man-Au-Trol, Model 75 since each operator can machine 76 pieces per eight hour shift compared to 40 pieces by our former method – that appearance is improved because of superior finish obtained by using single point cutting tools instead of ground formed tools."

How about you? Are you employing all the advantages offered by Bullard Man-Au-Trol, Model 75, to your machining problems.

To cut costs when cutting metal . . . buy BULLARD

Call your Bullard Sales Engineer, he's as near as your telephone or write

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT



An aluminum cable reel being high-quality sigma welded in a fast, clean operation. Throughout industry, sigma welding is helping produce parts like these more efficiently than ever before.

SAVED-50% of fabricating cost...

by using

SIGMA WELDING

Sigma welding's combination of automatic wire feed, and dependable argon gas-shielding accounts for the fifty per cent cost saving made in fabricating aluminum cable reels like the one shown above. Top quality welds are made in these ¼ and ½ inch thick aluminum parts at speeds up to 20 inches per minute—and no post weld treatment is necessary.

The Ease of Handling gained by automatic wire feed both simplifies and speeds welding operations. A shield of inert argon gas envelopes and protects the weld puddle from harmful effects of the atmosphere, and eliminates need for flux.

Sigma Welding Is Ideal for a Wide Range of Jobs because it joins all commercially fabricated metals, and can attain full penetration up to ¼ inch in a single pass. A complete line of portable manual, and automatic mechanized apparatus is available—and all are easy to operate and maintain.

For more information on sigma welding, or on any of LINDE's modern methods of joining metals, call your local LINDE representative—or write for free illustrated literature. Start saving now, do it today.

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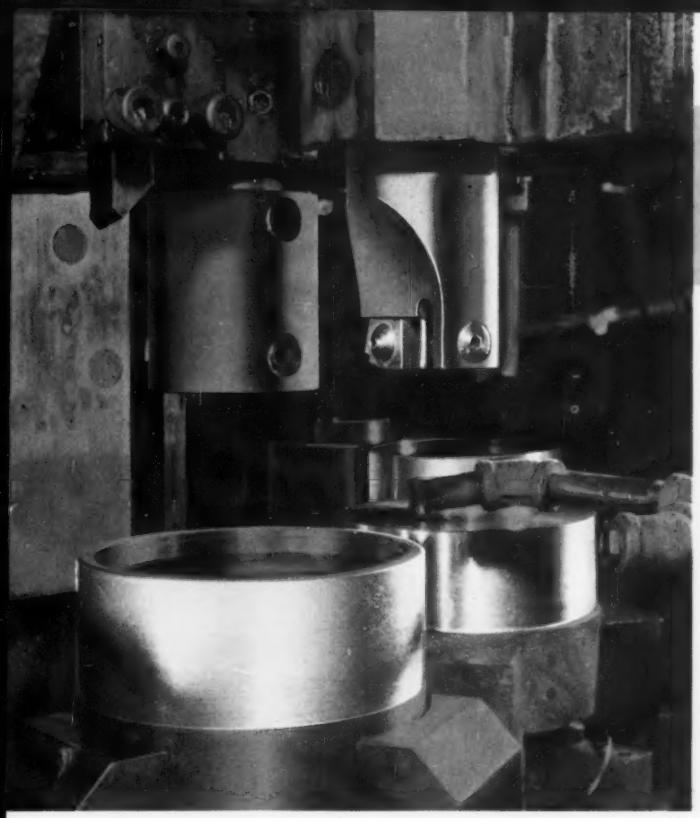


TOOL NEWS carbide

Throw-away inserts in micro-adjustable tools drop costs from $4.50 per 1000 pieces to 43¢

WESSON Boring Bars Cut Turning Costs

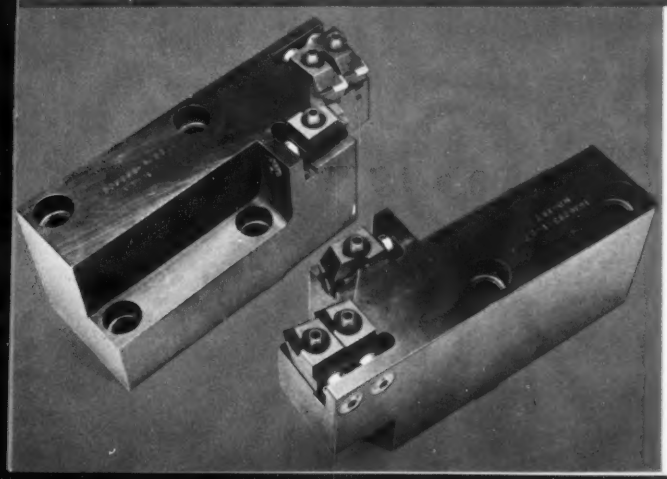
Replacing conventional single point tools, Wesson-metal throw-away inserts in micro-adjustable **WESSON** boring bars are showing the following savings on a planet carrier housing turning operation:

Tool grinding eliminated
Tool cost cut from $4.50 to 43c per 1000 pieces
Tool-change down-time cut 93%
Tool re-setting after sharpening eliminated
Pieces per tool change almost doubled

Since the only change in the tooling, when dull, is to index the insert or replace it after 8 indexes, no tool-change-adjustment is required after the first setup. The latter is quick and positive because of the micro-adjustment feature (0.001 inches per graduation on the screw head).

Again, therefore, **WESSON** insert tooling demonstrates the ability to slash the really important tool costs—those hidden costs in tool grinding, down time, etc.—which usually far outweigh initial tool cost. The reduction in initial cost in this case was only 4 cents per 1000 pieces. The "upkeep" cost, however, was slashed $4.00 per 1000 pieces . . . without even figuring in the eliminated down time.

For data on these tools ask for Bulletin #MB-157.

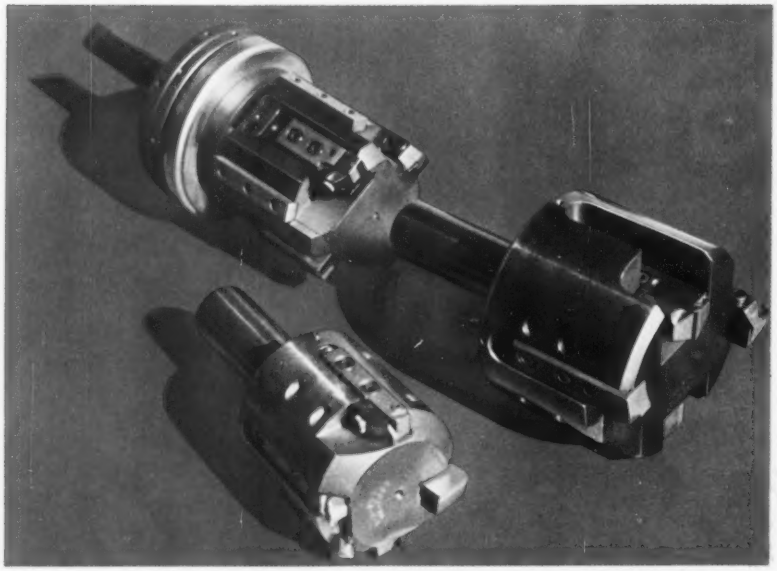


Tool Blocks for Throw-Aways are Micro-Adjustable

The **WESSON** tool blocks shown here are used to rough and finish turn and face transmission parts on an Ex-Cell-O two-spindle machine. Micro-adjustment permits rapid setup, each division on the calibrated screwhead being equal to 0.001 inch. The square inserts provide eight cutting edges, high production per insert, and low tool cost.

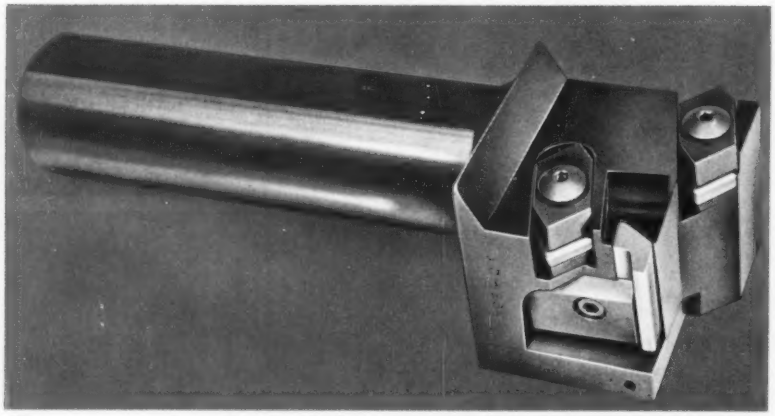
TOOL NEWS carbide

Throw-Aways for More New Uses



These three special tools perform a combined total of some 10 operations. The 4-tooth cutter in the rear is for counterboring. Its 4 teeth are micro-adjustable for diameter, the screw head being graduated in 0.001 inches of movement. Quill in the foreground is used for facing, forming a step, counterboring, grooving and chamfering. Tool at the right is used for combination of internal and external operations: turning two OD's, facing and counterboring. All have these features in common: They are designed to use Wessonmetal throw-away inserts; they are rapidly set up; they cut down-time for tool changing to a minimum; they eliminate all tool grinding; and they greatly reduce tool costs per piece produced.

Both Throw-Away and Slug-Type Inserts Used in Tool Holders



Throw-aways may be combined with slug-type inserts to effect optimum machining efficiency and economy. For instance, use of both slug type (on-end) inserts and throw-away types in the same tool holder is recommended where grooving is to be combined with such operations as turning or chamfering. Reasons: wear is greater on grooving than chamfering tools. Slug type insert can be quickly re-ground. Special throw-away insert for this use could not be indexed and would be too costly. Shown here is a typical tool holder with both types of inserts.

tools carbide Wessonmetal

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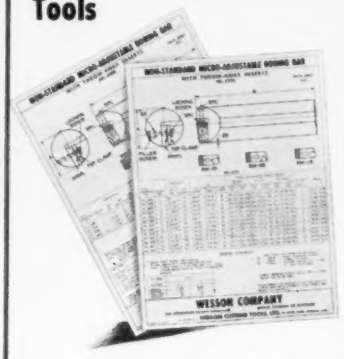
Ideas in Throw-Away Insert Micro-Adjustable Tools



Get our Bulletin #MB-157

You'll find it valuable in planning for the retooling of turret lathe operations on which you want to cut tool costs per piece and down-time for tool changes. Also gives specifications and prices, shows standard replacement parts, 15 line drawings.

Bulletin #PG-157

Get this bulletin. It will tell you how to cut your grinding costs on carbide tools, how to get greater diamond wheel life; how to boost grinder output per hour from 30% to 50%; how unskilled operators can get better tool finishes than skilled operators on other grinders; how to cut tool regrind cost almost in half.

LITHO IN U.S.A

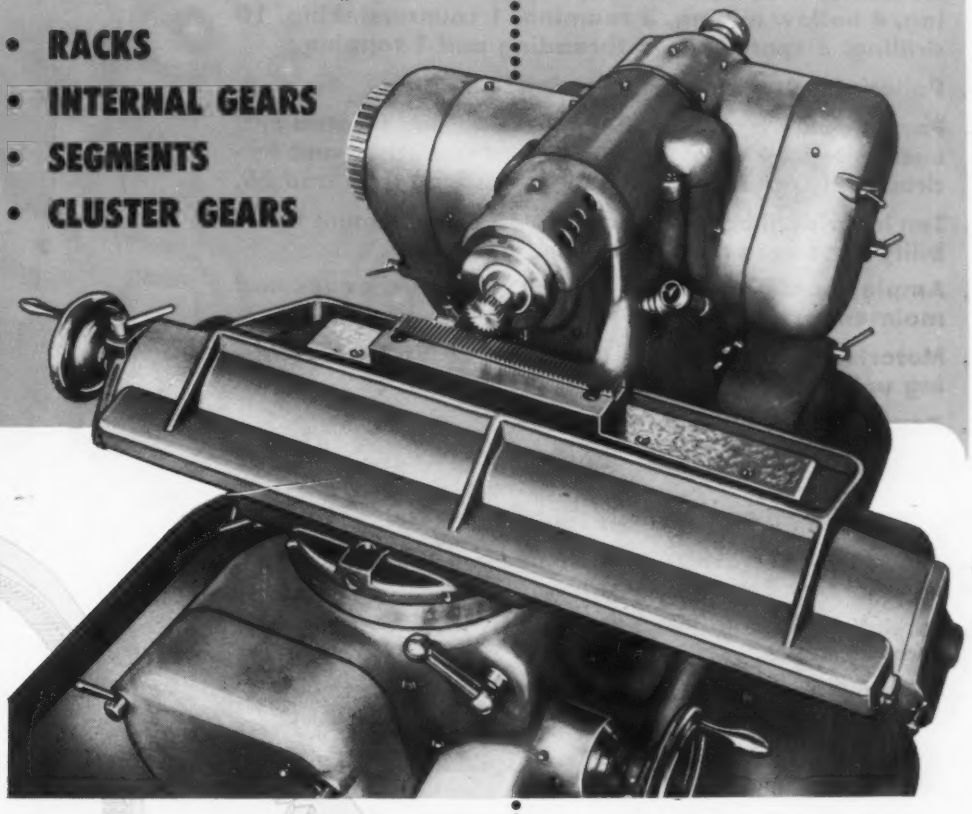
MIKRON

Fine Pitch

RACK & GEAR CUTTER
No. 134

...for

- **RACKS**
- **INTERNAL GEARS**
- **SEGMENTS**
- **CLUSTER GEARS**



ANOTHER machine in the MIKRON line— ***Controlled Accuracy, High Finish, Ease of Set-Up.*** **The precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.**

WORK PIECE CAPACITY

RACKS
(Straight or Skew)
to 36" long x 1" wide.

SEGMENTS & CLUSTERS
to 3⅛" dia. x 1" wide.

INTERNAL GEARS
to 4" dia. x 1" wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual leadscrew spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

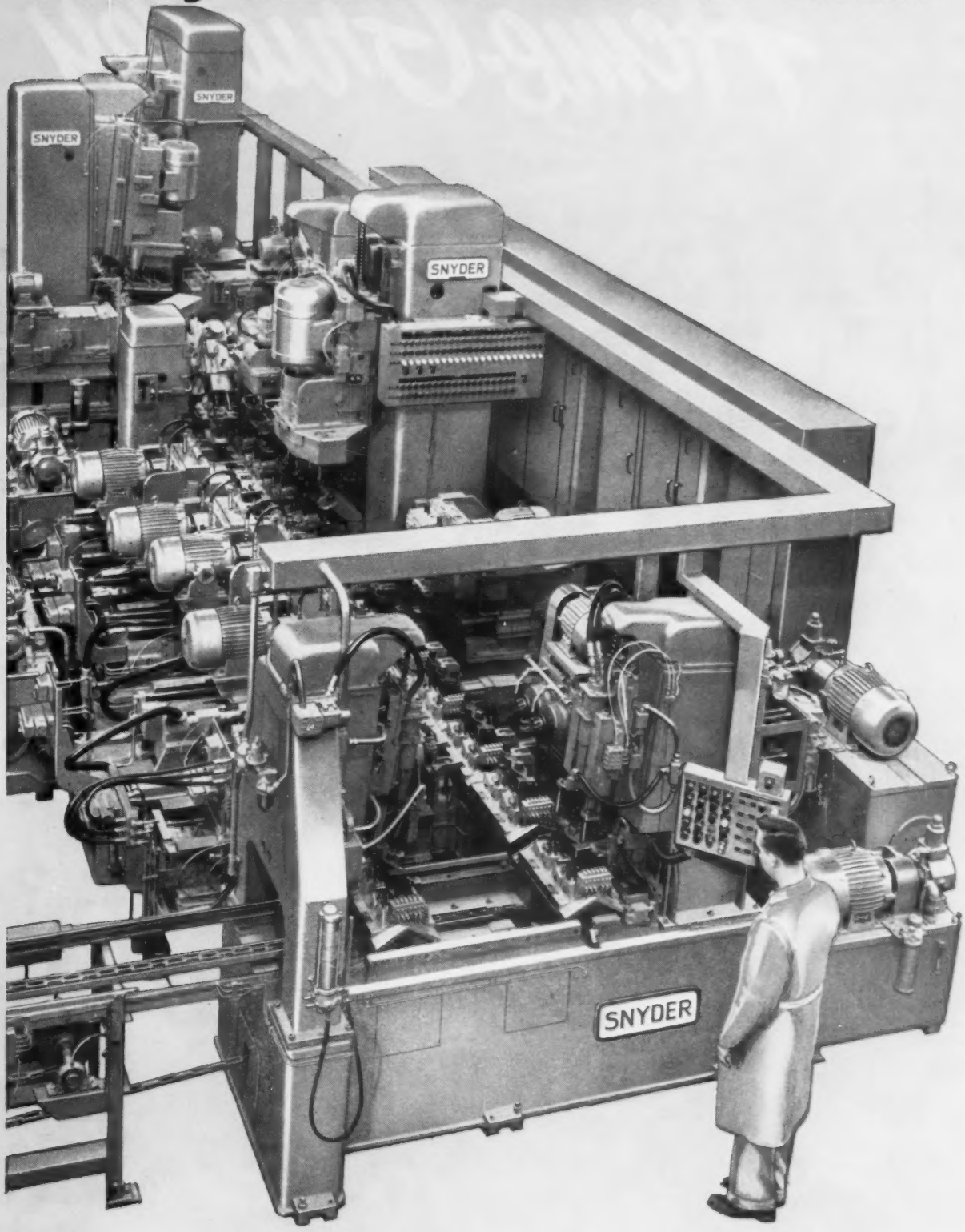
SNYDER

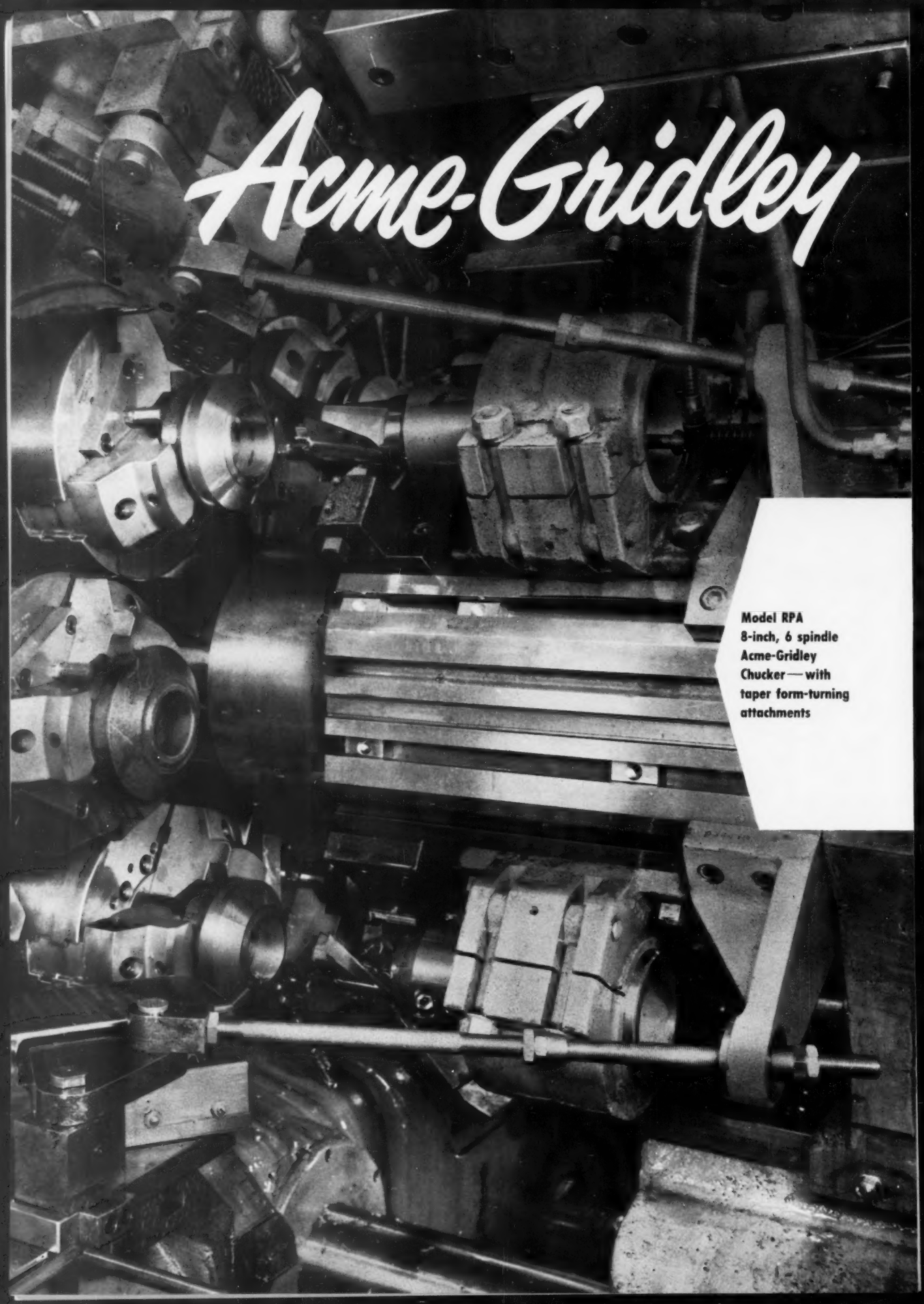
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

Several Semi-Standard Machines with Steering Knuckles for British Car Builder





Model RPA
8-inch, 6 spindle
Acme-Gridley
Chucker — with
taper form-turning
attachments

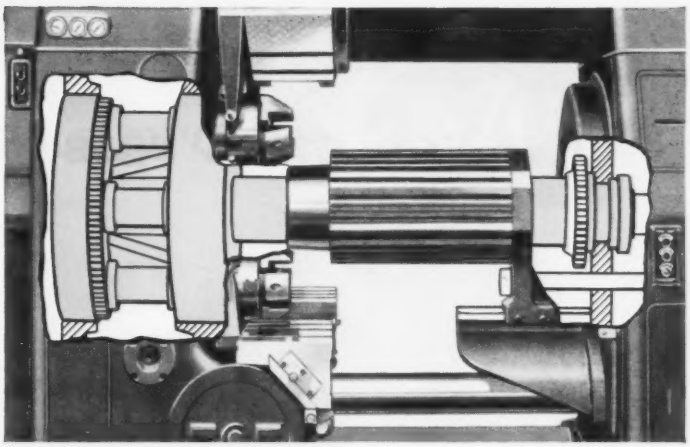
sound basic design

means greater production at lower cost

Accurate alignment of the tools and the work, every time the carrier indexes—and the rigid maintenance of this very precise alignment throughout every machining operation—provides greater precision all day long, less inspection, fewer rejects.

This accuracy resulting from sound basic design is one of the many reasons why Acme-Gridleys are setting new records for consistently accurate production every day.

- Spindle-carrier integral with stem.
- End toolslide provided with bushings closely fitted to carrier stem and protected by front and rear seals.
- Toolslide further supported by rugged guide arm to heavy guide plate below carrier stem.
- Two wide spindle carrier bearings in headstock frame and a heavy-duty bearing in gear box provide maximum support.



LET US TELL YOU MORE ABOUT *Acme-Gridley* BASIC DESIGN

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark, N. J. • Chicago, Ill. • Detroit, Mich.

For more information fill in page number on Inquiry Card, on page 229

When you can't raise prices, you

for production men

This Avey machine is used in a jet aircraft plant on the West Coast for drilling, boring, and spotfacing the flanges and periphery of a jet engine component.

The two Aveydraulic units mounted horizontally have 12″ ram travel. The third Aveydraulic unit, mounted vertically, has 16″ ram travel and a 6-speed gear box with a speed range of 150 to 1800 rpm. The vertical column has an in and out traverse of 20″; moves to a minimum of 15″ and a maximum bolt circle of 55″.

The 60″ Electrodex table is equipped with a master index ring with two rows of bushings, 96, 49, and 8 indexes respectively. The three heads can be programmed to the indexing of the table.

Another example of how Avey combines standard units to meet special production requirements.

for management

You can close up shop, of course, when your primary customer puts the lid on your price at the point where you run out of profits. You can look for another customer. You can try another market where the customers are more reasonable. But these are all expensive cures.

A more realistic approach is to take preventive action now. For every pound of cure, you can invest an ounce of capital in Avey production machines which can reduce your operating costs immediately. Then you can meet your customer's demands and stay in business.

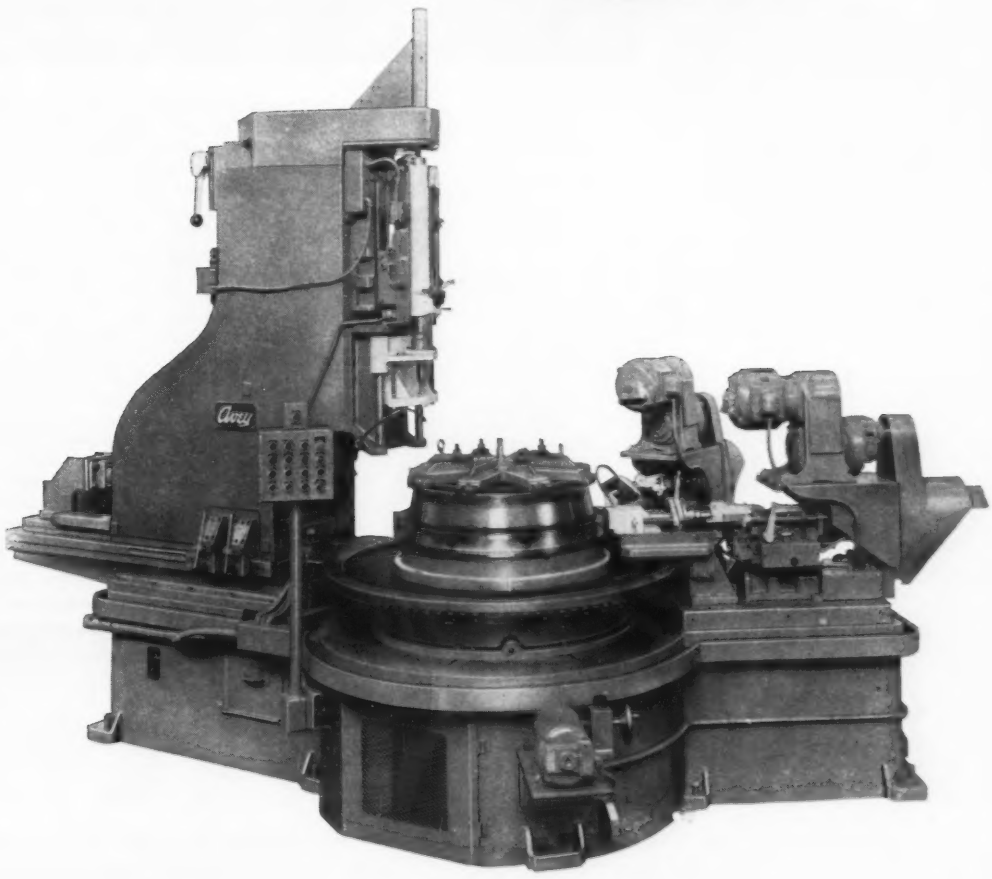
If your replacement reserves are limited, you can finance Avey equipment on a pay-as-you-produce plan. In many cases, Avey machines have returned their original investment so quickly that they earn clear profit within a year.

AVEY DIVISION, THE MOTCH & MERRYWEATHER MACHINERY COMPANY, BOX 625, CINCINNATI 1, O.

drilling, tapping, production machines

can still make profits

Avey



Use WELDED STEEL for Greater Strength with Less Weight!

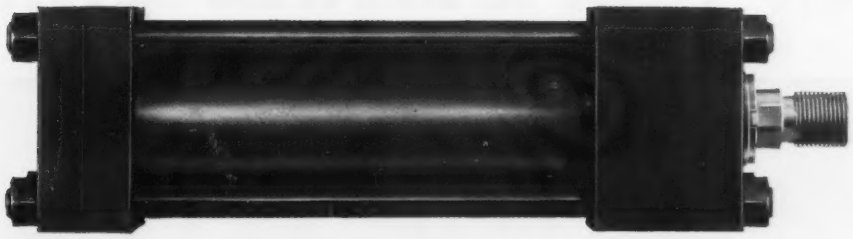
The weldment shown above is one half of the base for a 300,000 KW Steam Turbine...it weighs over 100 tons. This base, and the units shown at left, are typical of the thousands of Steel-Weld Fabricated parts and assemblies produced by Mahon each year for manufacturers of processing machinery, machine tools, and other types of heavy mechanical equipment. Are you taking full advantage of the economies offered by welded steel components in your products? In the design of almost any type of heavy machinery, or mechanical engineering project, there are parts and subassemblies that can be produced more economically and more satisfactorily in welded steel . . . because, in weldments you get greater strength with less weight, plus the additional advantages of greater rigidity and 100% predictability. When you consider weldments, you will want to discuss your requirements with Mahon engineers, because, in the Mahon organization you will find a unique source for weldments or welded steel in any form . . . a fully responsible source with complete facilities for design engineering, fabricating, machining and assembling . . . a source where design skill is backed-up by craftsmanship which assures you a finer appearing product embodying every advantage of Steel-Weld Fabrication. See Sweet's Product Design File for information, or have a Mahon sales engineer call at your convenience.

THE R. C. MAHON COMPANY • Detroit 34, Michigan
Sales-Engineering Offices in Detroit, New York and Chicago

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

For more information fill in page number on Inquiry Card, on page 229



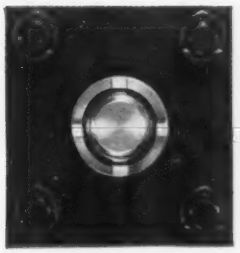
designed for leadership!

The superiority of Hannifin cylinders begins on the drawing board, where Hannifin designers have originated feature after feature not found in other air and hydraulic cylinders. But it doesn't end there...

Hannifin offers more kinds of cylinders, more sizes, more mounting styles. Each manufactured with such exacting control of dimensions and finishes that it not only looks like a better cylinder—its performance proves it!

As more and more discriminating specifiers and buyers are finding, the extra quality you get from Hannifin costs you no more, can usually be delivered sooner.

Why not specify Hannifin by name when you buy?



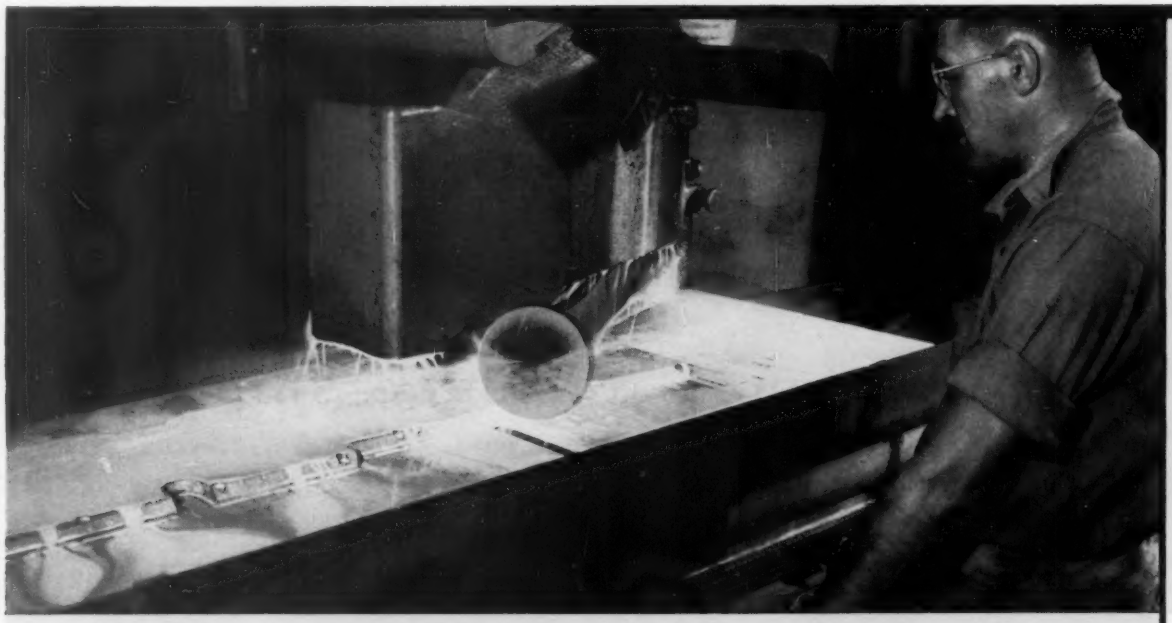
AIR AND HYDRAULIC

HANNIFIN

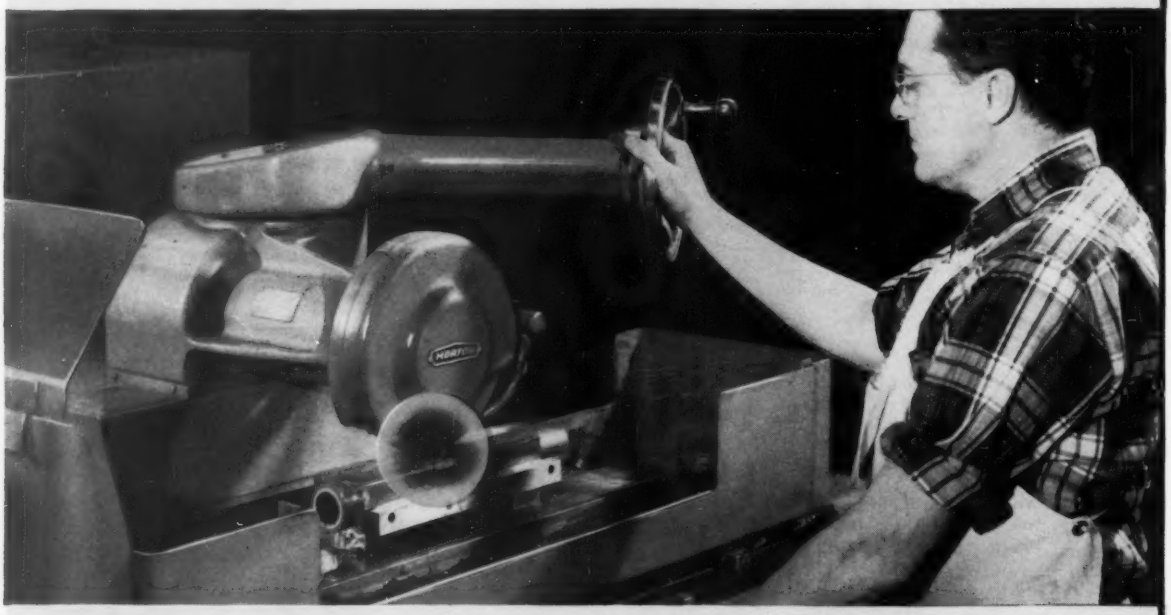
POWER CYLINDERS

Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Corporation, 509 South Wolf Road, Des Plaines, Illinois.

With your surface grinders



ON BIG SURFACE GRINDERS, like Blanchards, Hanchetts, Mattisons, Thompsons and Hills, G BOND-32 ALUNDUM wheels bring you many "Touch of Gold" advantages. Such as cooler, faster cutting action . . . heavier cuts without burning . . . closer tolerances and smoother finishes . . . less dressing and more pieces per dressing . . . more work, and more kinds of work, per wheel.



ON SMALL SURFACE GRINDERS, including toolroom machines, G BOND-32 ALUNDUM wheels give you the same value-adding, cost-cutting benefits. They're ideal on grinding machines like Brown and Sharpes, Crystal Lakes, Deltas, Doalls, Gallmeyer and Livingstons, LaSalles, Reids, Sanfords, Taft-Peirces, Nortons and many others.

. . . TAKE DEEP COST CUTS

Norton G BOND-32 ALUNDUM wheels add the profit-boosting "TOUCH of GOLD" to any size machine*

W-1789

The Norton G Bond is the most efficient ever developed for precision and semi-precision grinding. It holds each abrasive grain just long enough for maximum cutting action, assuring a constant grinding surface of fresh, sharp cutting edges.

Norton 32 ALUNDUM abrasive is another big advancement in grinding progress — ideal for surface grinding requiring fast stock removal and heavy feeds.

Remember: only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost. See your Norton Distributor for further facts on how the G Bond and 32 ALUNDUM abrasive combine to form the best "Touch of Gold" team for grinding high speed and alloy steels. (For other applications investigate other Norton ALUNDUM and CRYSTOLON* abrasives.) Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

NORTON

ABRASIVES

Making better products . . .
to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels • Grinding Machines • Refractories

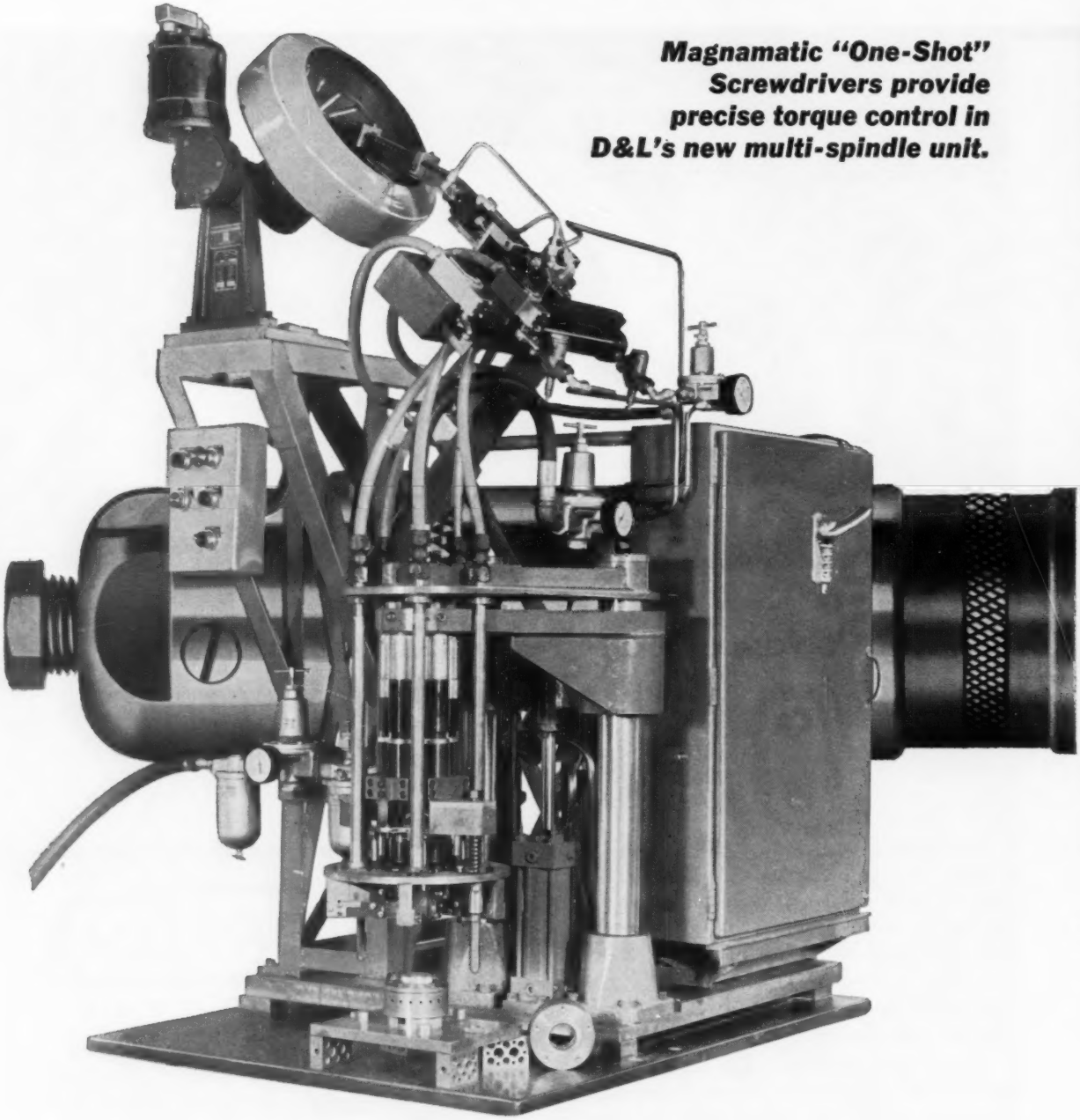
BEHR-MANNING DIVISION:
Coated Abrasives • Sharpening Stones • Behr-cat Tapes

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

For more information fill in page number on Inquiry Card, on page 229

D&L* selects

Magnamatic "One-Shot" Screwdrivers provide precise torque control in D&L's new multi-spindle unit.



D&L TOOL AND MACHINE COMPANY*

990 S. Oakwood, Detroit 17

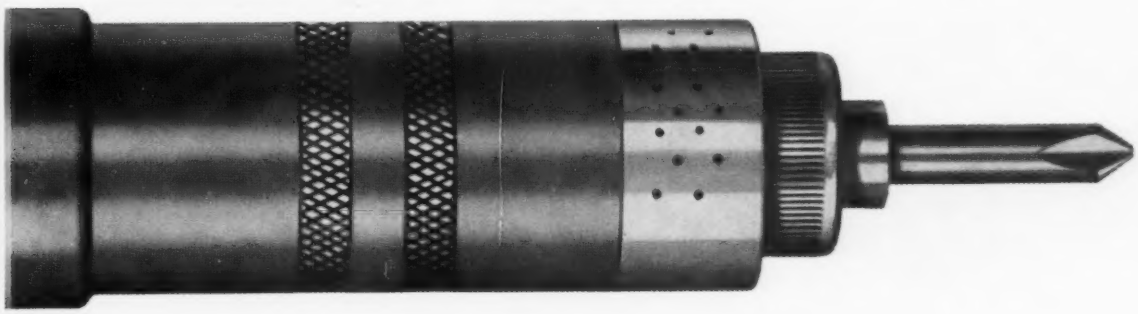
Manufacturers of automatic single and multi-spindle screwdrivers and nutrunners for automation assembly lines.

"MAGNAMATICS"...

The D&L Tool and Machine Company's newest development is a fully automatic multiple screwdriver that feeds and drives five screws simultaneously *to desired torque* . . . at a rate of 3500 screws an hour!

D&L's development engineers specified "One-Shot" Magnamatic drivers. Studies from hundreds of difficult fastening assignments proved that Magnamatic is the only screwdriver clutch that fully meets the demands of high speed, fully automatic screwdriving equipment. Because Magnamatic "thinks for itself", its torque-setting clutch jaws disengage the instant desired fastener torque is reached . . . there's no clutch ratcheting or impacting to cause jaw wear . . . the absence of ratcheting means consistent torque settings that don't need readjustment; the absence of impacting means longer bit life, and no possibility of burred screw heads, stripped threads, or sheared fasteners . . . air line pressure variations don't affect delivered torque . . . torque output can be changed to suit job requirements.

Investigate the possibilities of Magnamatic. Let our Field Engineers show you how the wear-free clutch components of Magnamatic "One-Shot" screwdrivers and nutrunners will insure accuracy and consistency in all automatic multiple units.



Complete line of motors and clutches available for constructing multi-spindle screwdriving and nutrunning arrangements. Capacities #2 screws to bolts requiring 120 pounds of torque.

Portable multi-spindle units featuring Magnamatic "One-Shot" nutrunners and screwdrivers are also available.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Chicago Pneumatic Tool Company, Dept. M-51.
8 East 44th Street, New York 17, N. Y.

_____Please send me full information about multi-spindle units featuring "Magnamatic" screwdrivers.

_____Please send me FREE booklet SP-3165 "Magnamatic Case Histories"

_____Have representative call.

Name_____Title_____

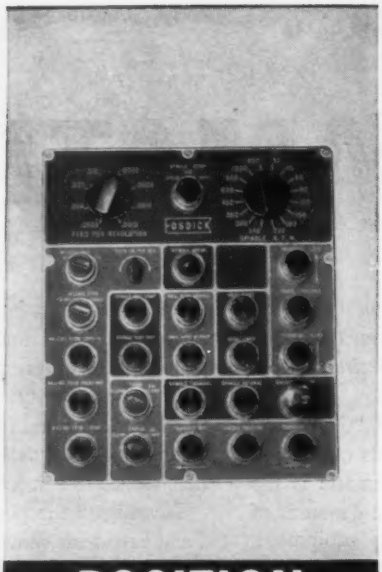
Company_____

Address_____

City_____Zone_____State_____

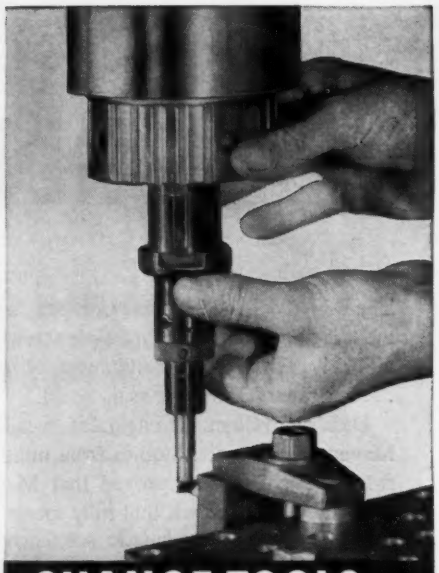
MEASURE

Dial dimension direct from print. There are two sets of direct-reading drum dials, one for longitudinal, the other for transverse position. Operator simply sets dials so that numbers on dials correspond with numbers on blueprint. Simple. Direct. Precise.



POSITION

Press two buttons, one for longitudinal, one for transverse positioning. Table, and work, are automatically positioned, and clamped under the tool, accurate to ± .0001"! Accuracy is dependent upon highest-quality gages, not upon screw threads. Sensitive .0001 Dial Indicators maintain a positive check at all times.



CHANGE TOOLS

Tool changing takes less than 10 seconds, with BF spindle. Can be accomplished while table is positioning. Hole sizes are repeated within ± .0001", without resetting tools! High-precision tool holder is built right into the spindle of the Jig Borer. Adapters accommodate both standard and special-sized tools.

FOSMATIC JIG BORER

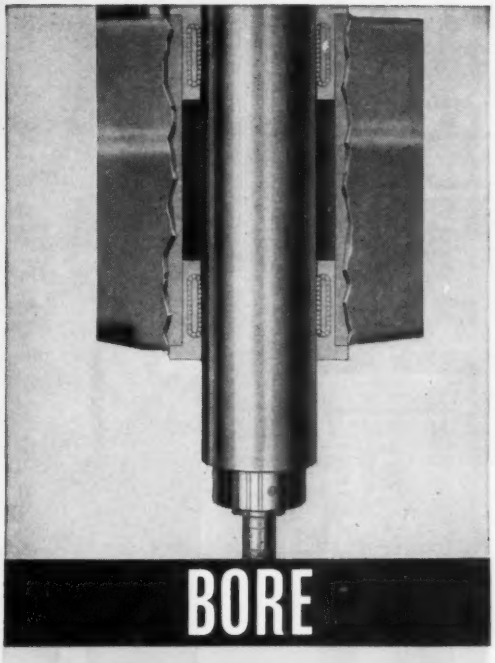
AUTOMATIC POSITIONING

DIRECT DIMENSION MEASURING

Represented by:

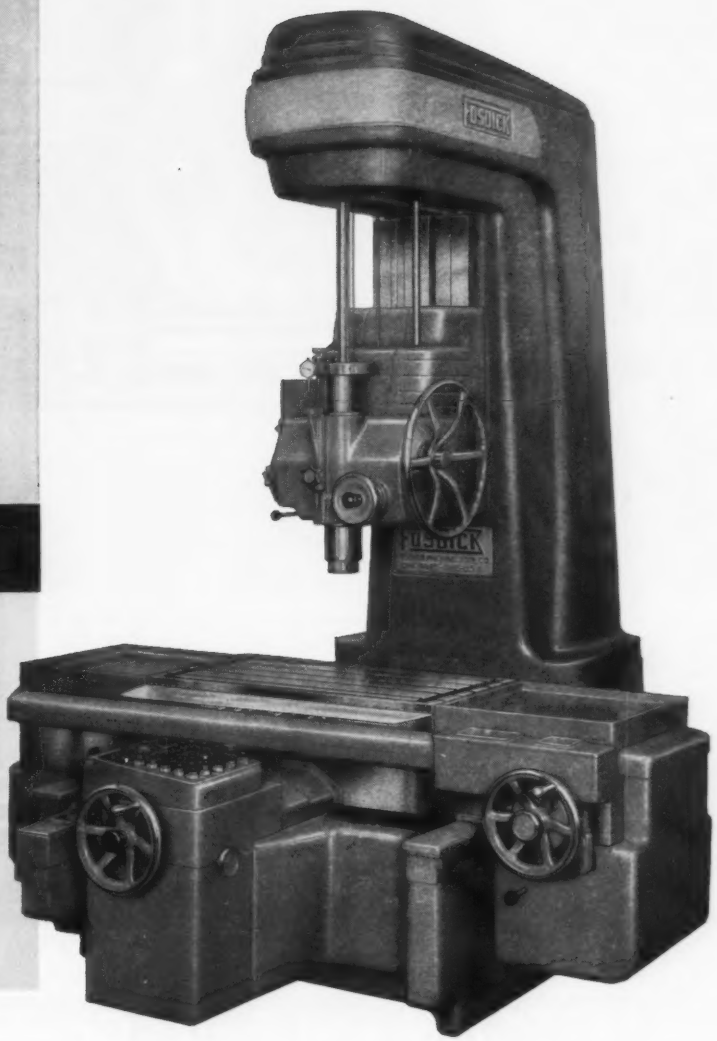
Cinrock Machinery Inc.

115 INDUSTRIAL EAST • P.O. BOX 505
CLIFTON, NEW JERSEY



BORE

Push-button precision boring. For finish boring, change tools quickly, then bore at touch of button. The hardened alloy steel quill rides on 800 preloaded balls mounted in precision bushings located permanently at top and bottom of head—as close as possible to spindle nose for maximum rigidity. Spindle is guaranteed not to exceed .0002″ runout at the end of 12″ proving bar!



MEASURE - POSITION - CHANGE TOOLS START BORING . . . ALL IN SECONDS!

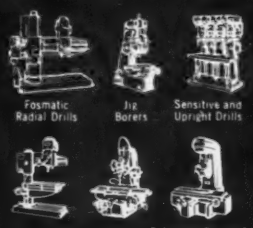
hole size and position accurate to ± .0001.

The new Fosdick Jig Borer can be used for the finest toolroom boring or for production of precision holes. Like the scores of Fosdick Jig Borers in plants throughout the United States, this machine will perform consistently to ± .0001″ . . . in measured table and saddle position as well as hole size.

The Fosmatic Jig Borer is extremely simple to operate. Changing of feeds and speeds, all movements of the table, saddle, and head can be accomplished by push button. Spindle is started and stopped by lever on head. Machine may be equipped with or without automatic positioning. Can be equipped for numerical control with either tape or card systems.

Other features available as extra equipment include Milling Feed, Rapid Traverse to Quill, coolant system and reversing motor for tapping.

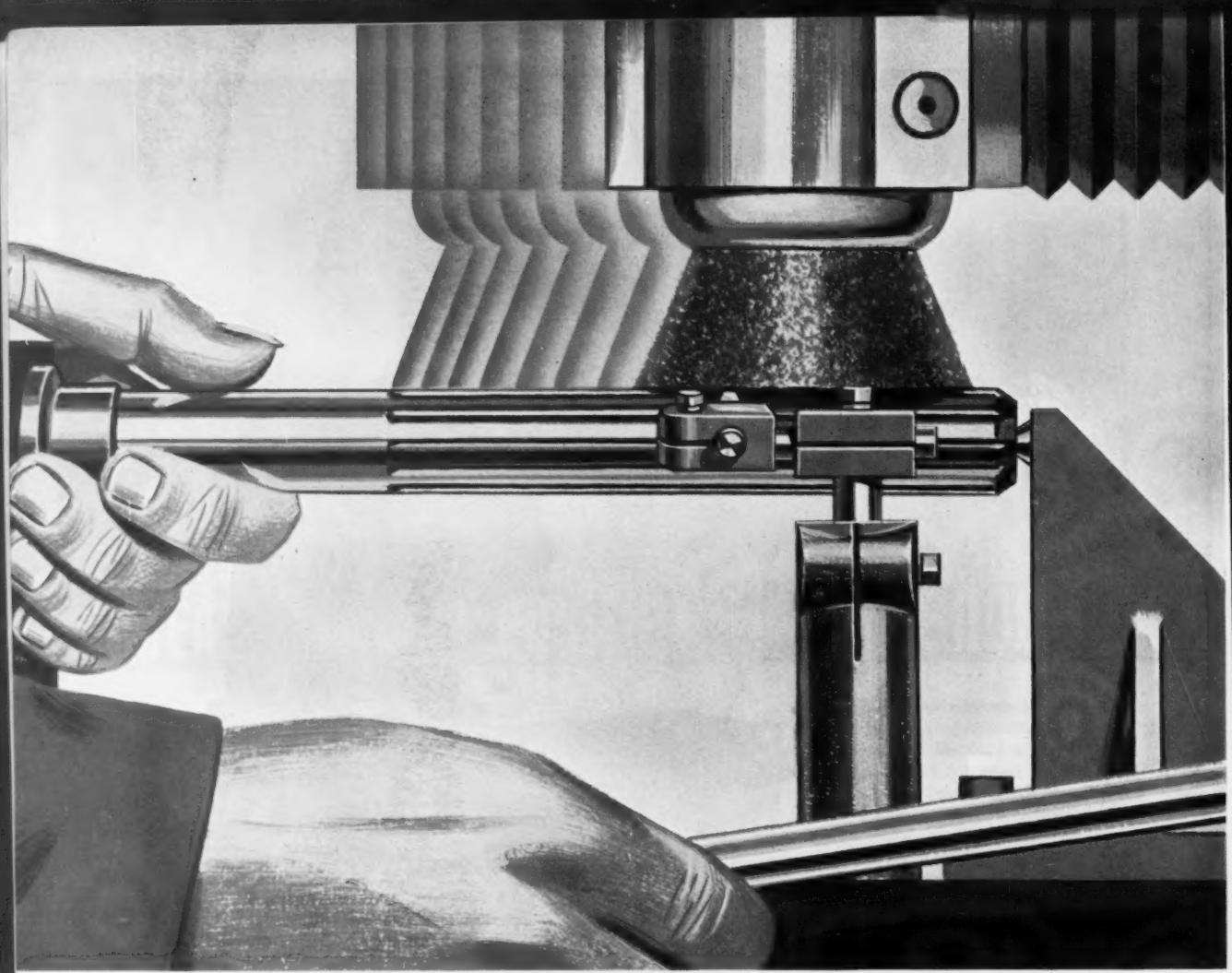
Ask for Fosmatic Jig Borer Bulletin, JB-M.



NEED DRILLING EQUIPMENT?
GET A PROPOSAL FROM FOSDICK!

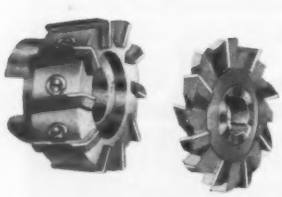
FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO



Oliver "ACE" Tool and Cutter Grinder

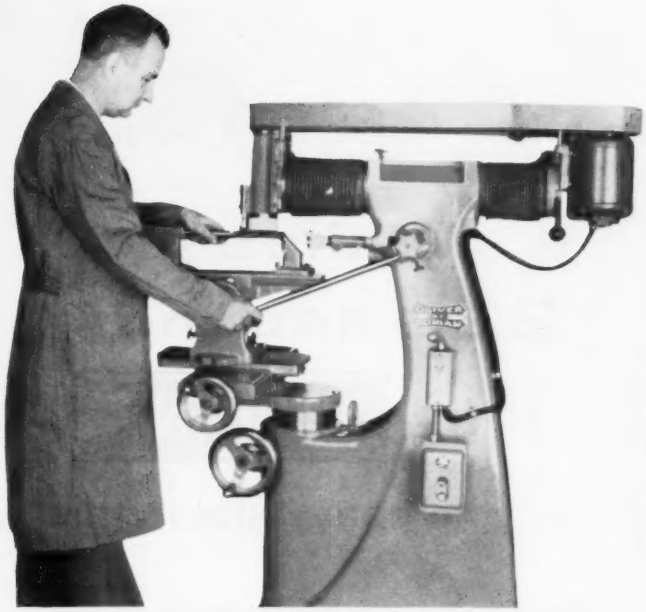
WHEEL TRAVERSES . . . *not the work!*



Face mills, reamers, hobs, spot facers—all cutters straight or spiral —are quickly, easily and economically sharpened with the Oliver "Ace."

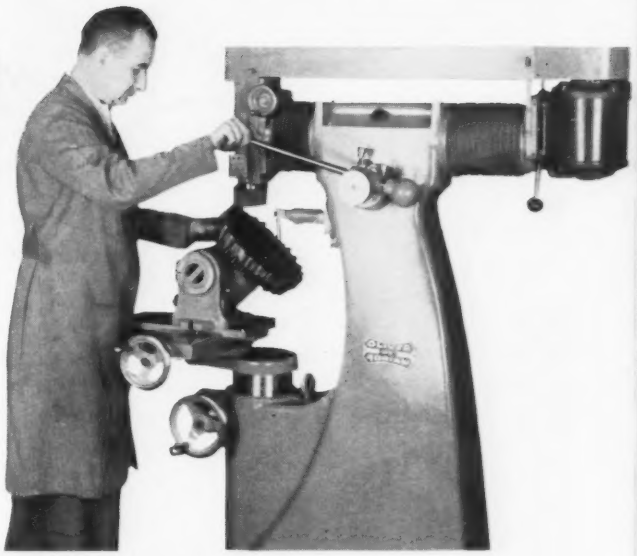
You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought *to the work*, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head moves in special bearings and is fully enclosed, sealed against dust and dirt. Further accuracy is assured because the wheel can be trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a universal tool grinder designed expressly for tool grinding—not a general purpose machine *adapted* to tool room work. It is simple to set up. All clearance angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.



OLIVER Standard "ACE"

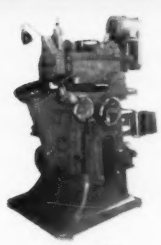
This machine is for high speed and light duty carbide grinding. Only two fixtures are required to handle a complete range of tool and cutter sharpening. Clearance angles are obtained by tilting the grinding wheel the desired amount as indicated on a scale graduated in degrees.



OLIVER Heavy-Duty "ACE"

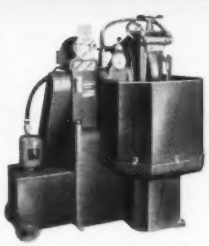
. . . for grinding tungsten carbide cutters and tools in all of their many forms. Because it is for use with hard metals, all components have been designed with rugged going in mind. Like the standard "ACE," grinding is done on the top tooth, not on the side of the cutter. The operator has full vision at all times.

More OLIVER of ADRIAN Tool Grinding Equipment



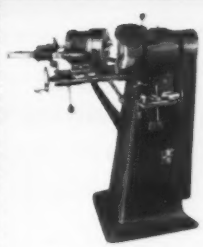
FACE MILL GRINDER

Completely automatic. A machine tool designed for accurate grinding. Wheel dressed with every stroke.



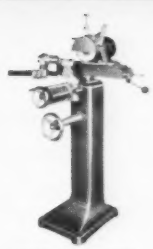
TEMPLATE TOOL BIT GRINDER

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.



No. 510 DRILL POINTER

Semi-automatic. For drills ¼" to 3" in diameter. No. 21 bench models available for size ½" and smaller.



DRILL POINT THINNER

For low cost reclaiming of drills. Corrects off-center and too-thick webs and out-of-index cutting edges.

DIE MAKING MACHINE

Produces dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. 5 designs in 2 types.

Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .

OLIVER of ADRIAN
OLIVER INSTRUMENT COMPANY
1410 E. Maumee St. • Adrian, Michigan

- ☐ Drill Pointer
- ☐ Face Mill Grinder
- ☐ "Ace" Universal Tool and Cutter Grinder
- ☐ Die Making Machine
- ☐ Drill Point Thinner
- ☐ Template Tool Bit Grinder

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

with micro-finish as a bonus,

it takes just 22½ seconds to LAPOINTE

the heavy slot in this

You know how long lapping takes! By materially reducing the former lapping operation, this nationally known manufacturer of household appliances cut production time substantially . . . now they rough-and-finish broach these deep, wide (.187″) slots *in one pass* at the rapid rate of 180 per hour (at 80% efficiency).

By converting to Lapointe-Broaching, they *really* saved themselves some money! Part of the saving comes about through the use of Lapointe-Broaches, with carbide inserts. Additional saving is accomplished with the extremely efficient Lapointe-built fixtures mounted on the In-and-Out table, hydraulically operated.

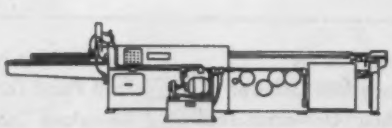
Wouldn't you like to discuss the possibility of saving money in *your* plant by Lapointe-Broaching? A well qualified Lapointe Field Engineer will call on you on request.

THE LAPOINTE MACHINE TOOL COMPANY

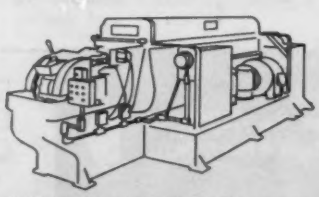
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

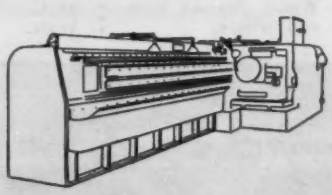
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



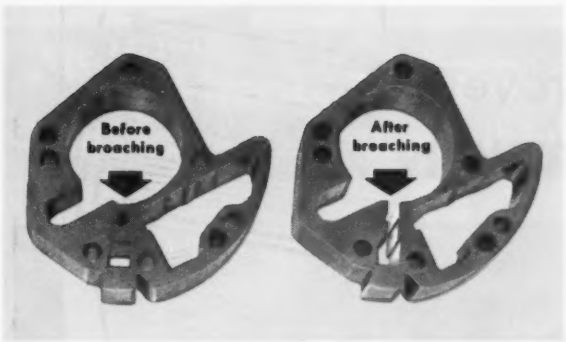
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

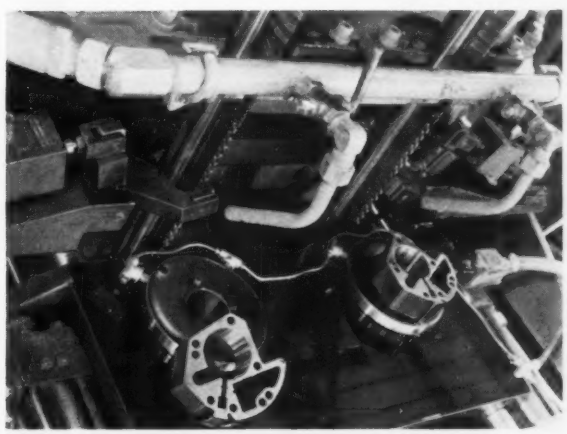


SRHE SINGLE RAM HORIZONTAL, ELECTRIC



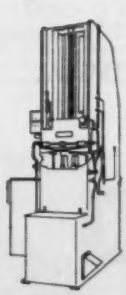
—BROACH

COMPRESSOR BODY!

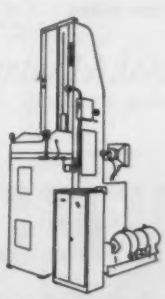


Pulling two broaches at a time, this Lapointe Vertical Pull-Down Broaching Machine (V-5, 20-ton, with special 90-inch stroke), is used for broaching these slots. Work nests have hydraulic clamping.

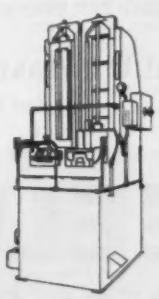
This series of Lapointe VPD Broaching Machines ranges from 5- to 50-ton capacity, 36- to 90-inch stroke.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

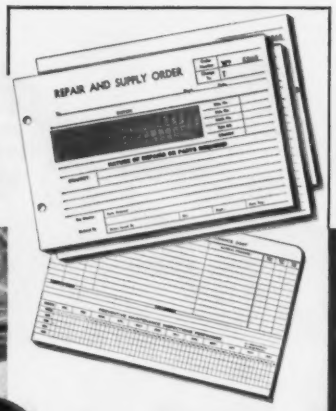
LAPOINTE

known to be the best in

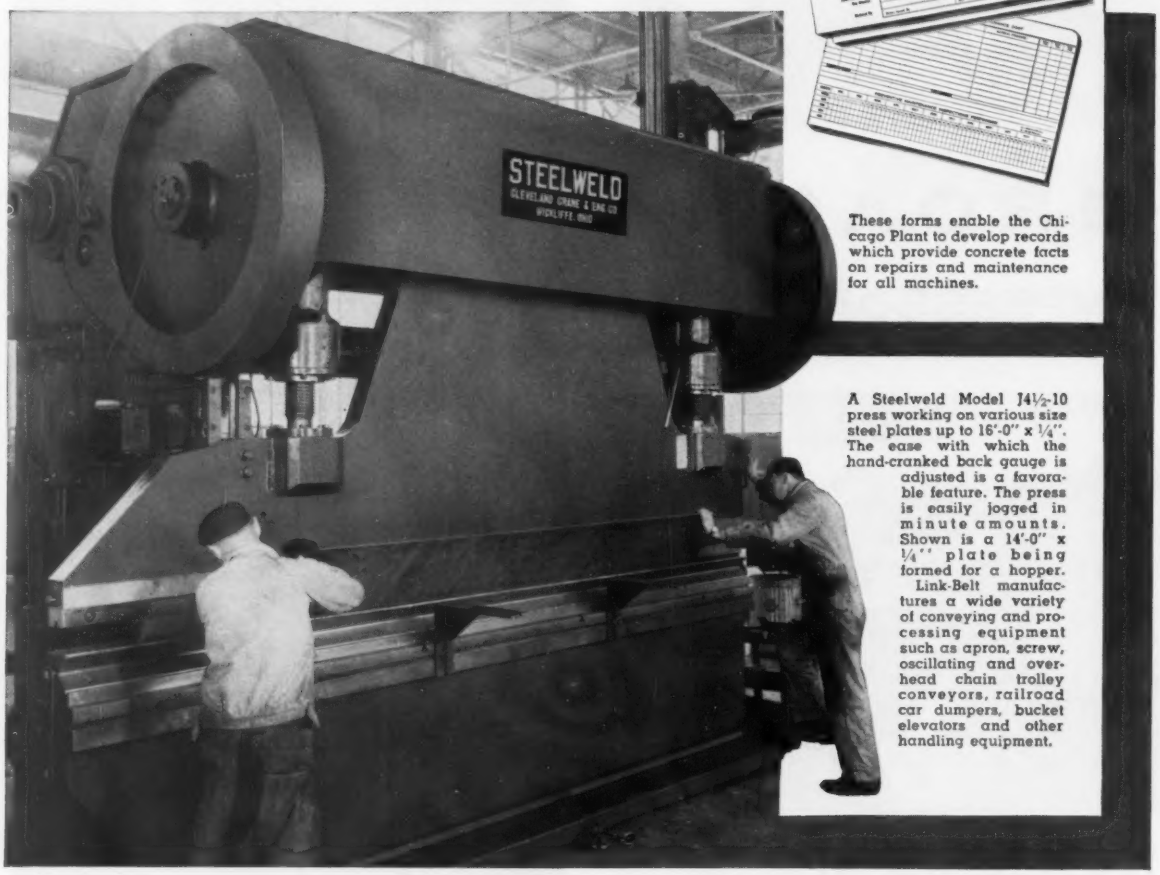
BROACHING

For more information fill in page number on Inquiry Card, on page 229

Accurate Records Prove
LOW COST OPERATION



These forms enable the Chicago Plant to develop records which provide concrete facts on repairs and maintenance for all machines.



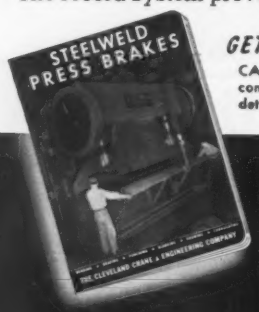
A Steelweld Model J4½-10 press working on various size steel plates up to 16'-0" x ¼". The ease with which the hand-cranked back gauge is adjusted is a favorable feature. The press is easily jogged in minute amounts. Shown is a 14'-0" x ¼" plate being formed for a hopper.

Link-Belt manufactures a wide variety of conveying and processing equipment such as apron, screw, oscillating and overhead chain trolley conveyors, railroad car dumpers, bucket elevators and other handling equipment.

SOME YEARS AGO the Pershing Road Plant of Link-Belt Company, Chicago, established a record system for keeping track of repairs and maintenance costs of all machine tools. This system provides a detailed history of maintenance required and lists every item of expense for every machine.

The record system proves that the maintenance cost for Steelweld machines, both bending presses and shears, is comparatively low.

Because of this, and the fact that Steelweld machines have many desirable operational features, a number of which are unavailable elsewhere, Link-Belt regards them highly. In fact, so much that 20 Steelweld Presses and Shears are now serving Link-Belt plants in nine cities.



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CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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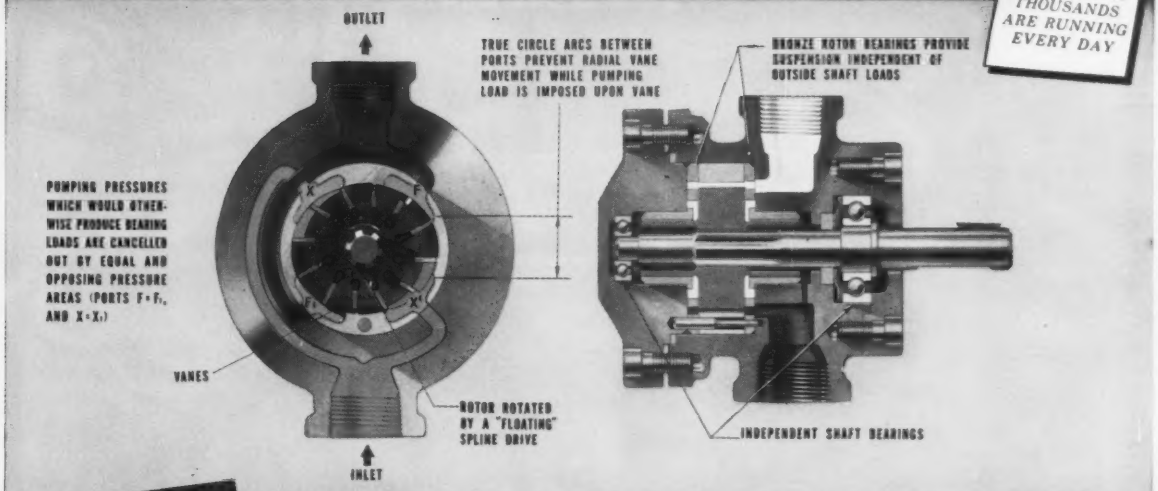
STEELWELD
PRESS BRAKES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

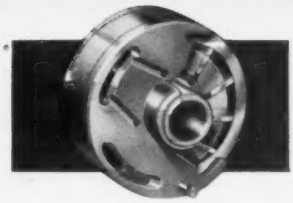
For more information fill in page number on Inquiry Card, on page 229

Question: Why are VICKERS Balanced Vane Type Pumps the most widely used oil hydraulic power pumps?

HUNDREDS OF THOUSANDS ARE RUNNING EVERY DAY


OUTLET
TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
BRONZE ROTOR BEARINGS PROVIDE SUSPENSION INDEPENDENT OF OUTSIDE SHAFT LOADS
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS F+F1, AND X+X1)
VANES
ROTOR ROTATED BY A "FLOATING" SPLINE DRIVE
INLET
INDEPENDENT SHAFT BEARINGS

Answer: Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.



For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (see below) are *the most widely used of all pumps in oil hydraulic service.*

Above is the pumping cartridge which is one of this pump's distinctive features. The many advantages listed at the right merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan
Application Engineering Offices: • ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated. Pressure-balanced porting plates maintain ideal running clearances.

FLOATING SPLINE DRIVE—Rotor is driven by a "floating" spline. Rotor and shaft have separate bearings . . . avoiding strain from drive misalignment.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

ABILITY TO TOLERATE DIRT—Clean oil is of great importance in a hydraulic circuit; but, in spite of care, dirt sometimes gets in. The Vickers Vane Type Pump will pass a reasonable amount of dirt without trouble and without grinding it up.

REPLACEABLE CARTRIDGE—Cartridge (illustrated above left) contains all pumping parts that move . . . none contact the housing. Working parts can be removed and inspected without disconnecting piping or drive coupling. Replacement cartridge kits are available and pumps need not be sent to the factory for repairs. Pump capacity can be changed by simply changing cartridge in the field.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

MINIMUM MAINTENANCE—Hydraulic balance . . . floating spline drive . . . independent bearings . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life. Then, a new cartridge completely rejuvenates the pump.

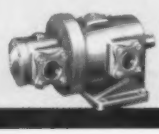
CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin 5002A.

7182

ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

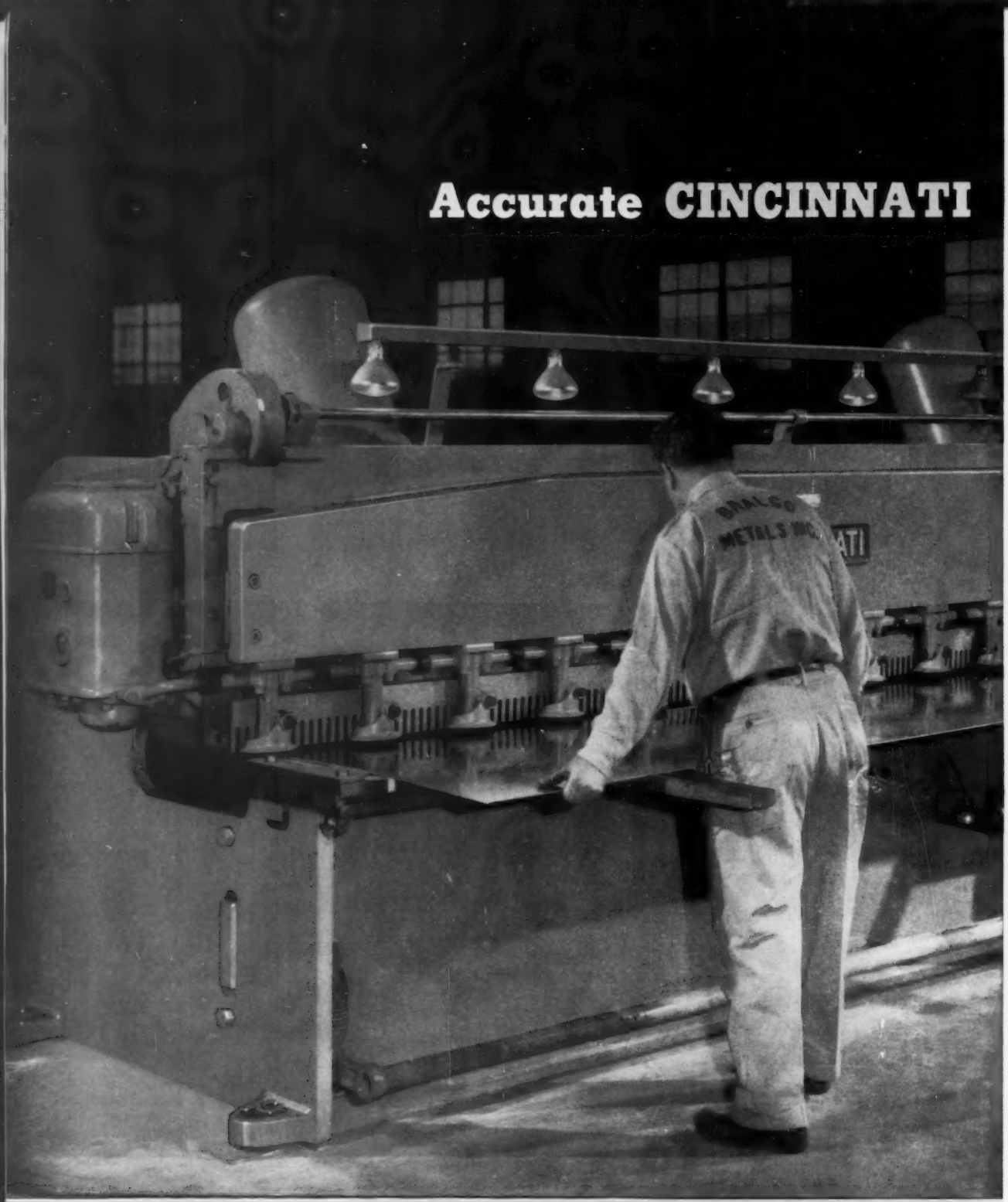
Single Stage. Pressures to 1,000 psi. Capacities to 55 gpm.

Two Stage. Pressures to 2,000 psi. Capacities to 55 gpm.


Double Pump—Two pumps for separate circuits driven by common shaft.

Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.

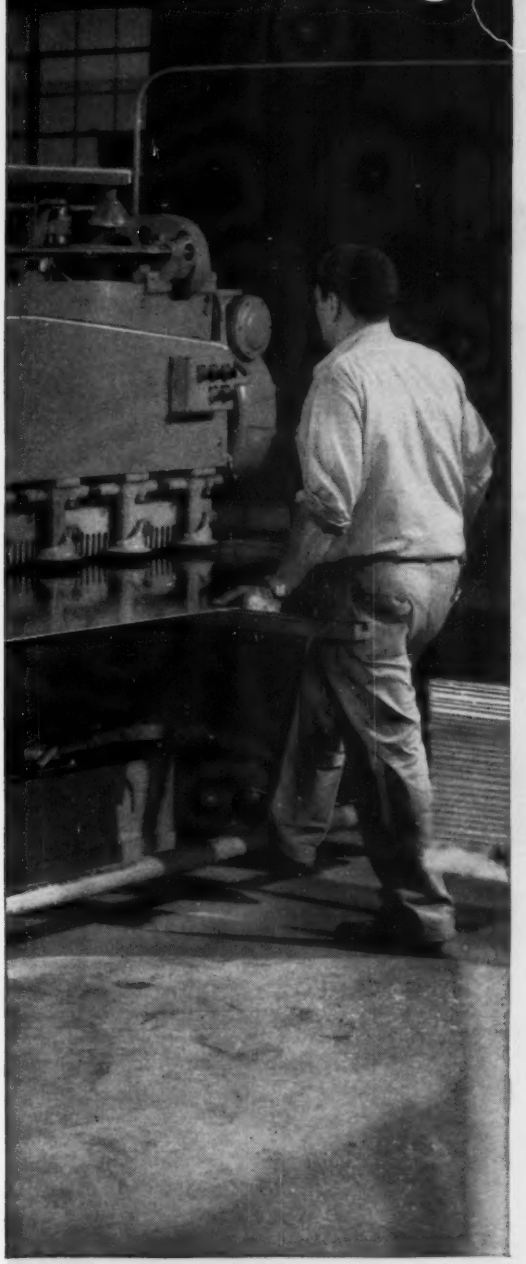
For more information fill in page number on Inquiry Card, on page 229



The 1412 Series Cincinnati Shear is shown shearing aluminum sheet. High pressure hydraulic holddowns automatically clamp different gauges of metal with the same pressure.

SHEAR brings substantial increase in sales...

at BRALCO METALS, INC., Los Angeles, California



Micrometer accuracy in squaring, notching and slitting of aluminum sheet and plate makes this Cincinnati Shear a profitable producer. The Bralco Company states "There is no question that this Shear has been responsible for a substantial increase in our sales." Maintained accuracy is insured by hydraulic holddowns, low rake upper knife, inclined ram and all-steel, weld free construction.

Write **Department D** for Shear Catalog S-7R. We also suggest that you contact our Application Engineering Department for information on your shearing problems.

Photos courtesy Bralco Metals, Inc., Los Angeles 22, California.

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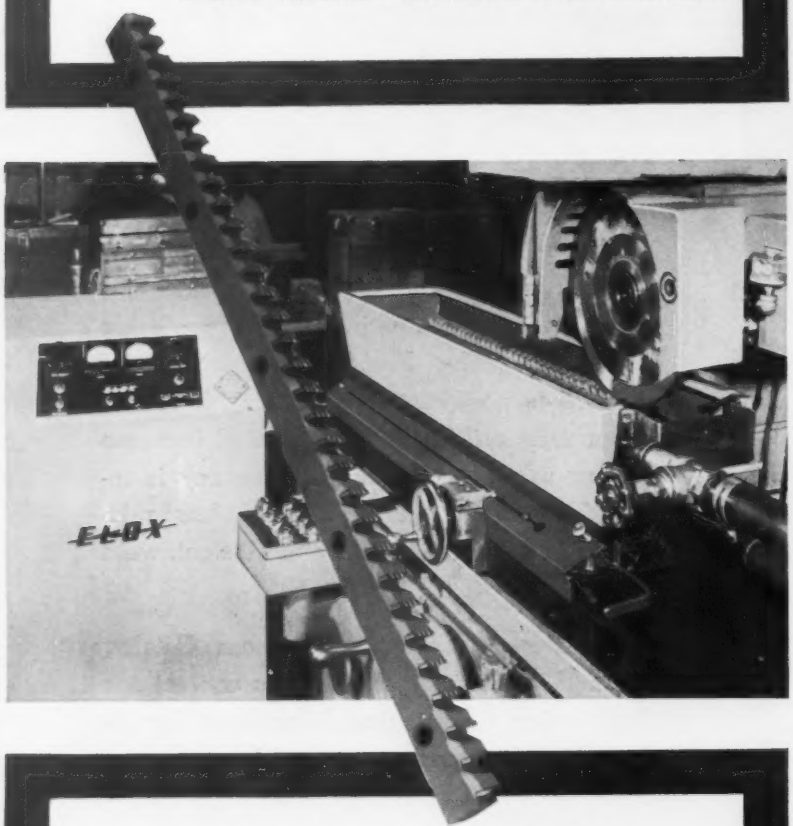
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

Reg. U. S. Pat. Off.

"elox* saves us $294 ...8 operations form grinding this broach"

Ford Motor Aircraft Division



The Job...

Broach, used for broaching the pine tree form on turbine blades of the J-57 Jet engine.

Savings on preformed carbide blanks	$ 32.00
Omitted operations savings	120.00
Diamond wheel savings	142.00
Sums up to	$294.00

NO DIAMOND WHEEL...

EDM substitutes inexpensive brass wheels costing less than $45 for expensive diamond wheels costing a minimum of $150. Brass wheels are formed for $1 as against a diamond wheel contour forming cost of $35.

NO PREFORMED CARBIDE BLANKS...

Conventional machining necessitates preformed tungsten carbide and preformed steel shanks. EDM machines the carbide, brazing material and steel simultaneously, and requires no indexing to assure a perfectly formed broach as to location and size.

OPERATIONS...

Conventionally machined, the pine tree broach requires 22 operations. EDM does it better in 14.

Electrical Discharge Machining has reduced the machining time of this intricate form in 32 carbide tipped teeth to a total time cycle of 33 minutes . . . one-half the time of abrasive grinding. Tolerances held to: +0, —.0002".

elox* corporation of michigan *T.M. Reg.

1833 N. STEPHENSON HWY. • ROYAL OAK 3, MICHIGAN

EDM keeps you ahead of competition • Grinding • Die Sinking • Form Grinding • Single Point and Insert Tool Sharpening

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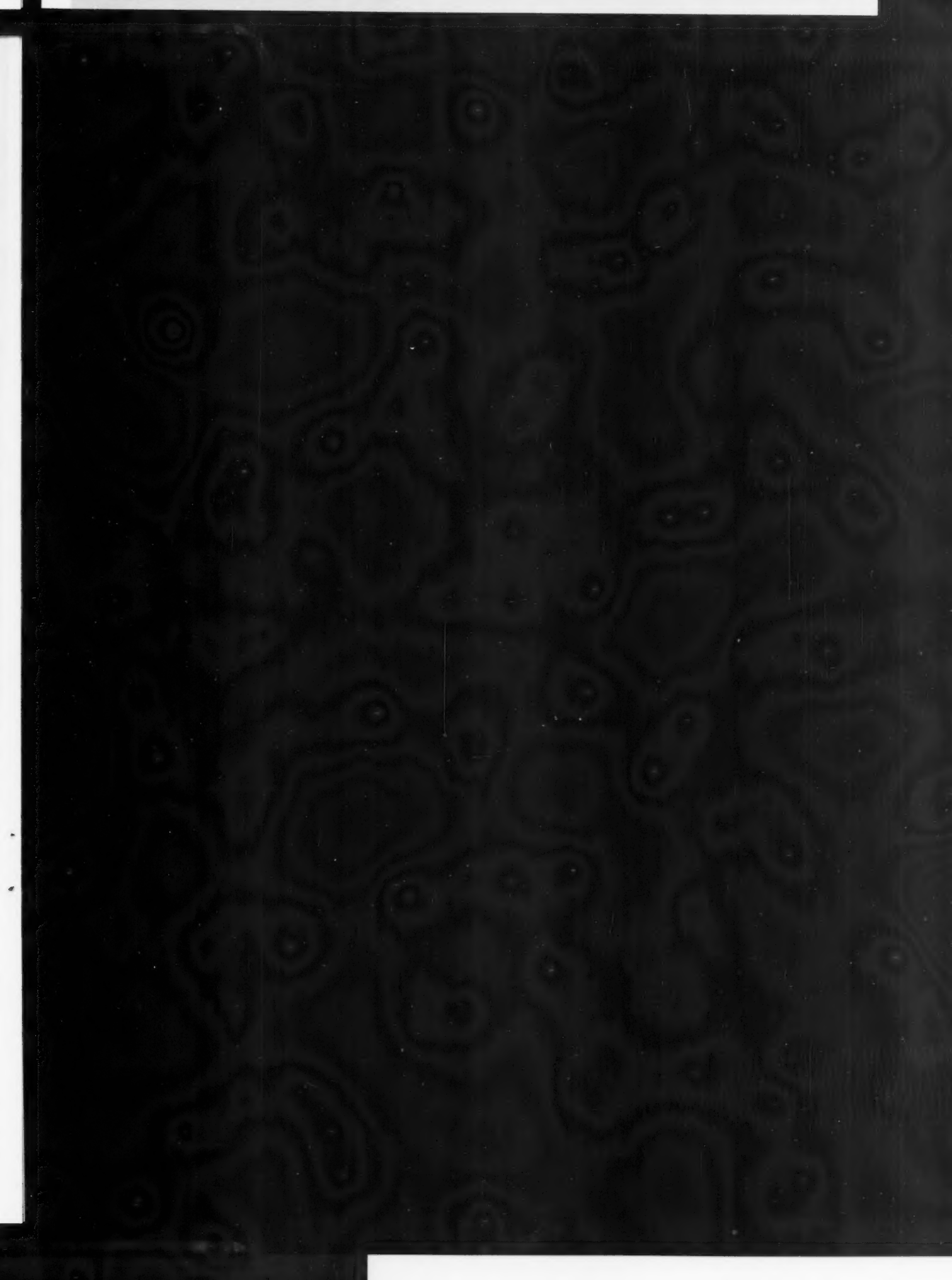

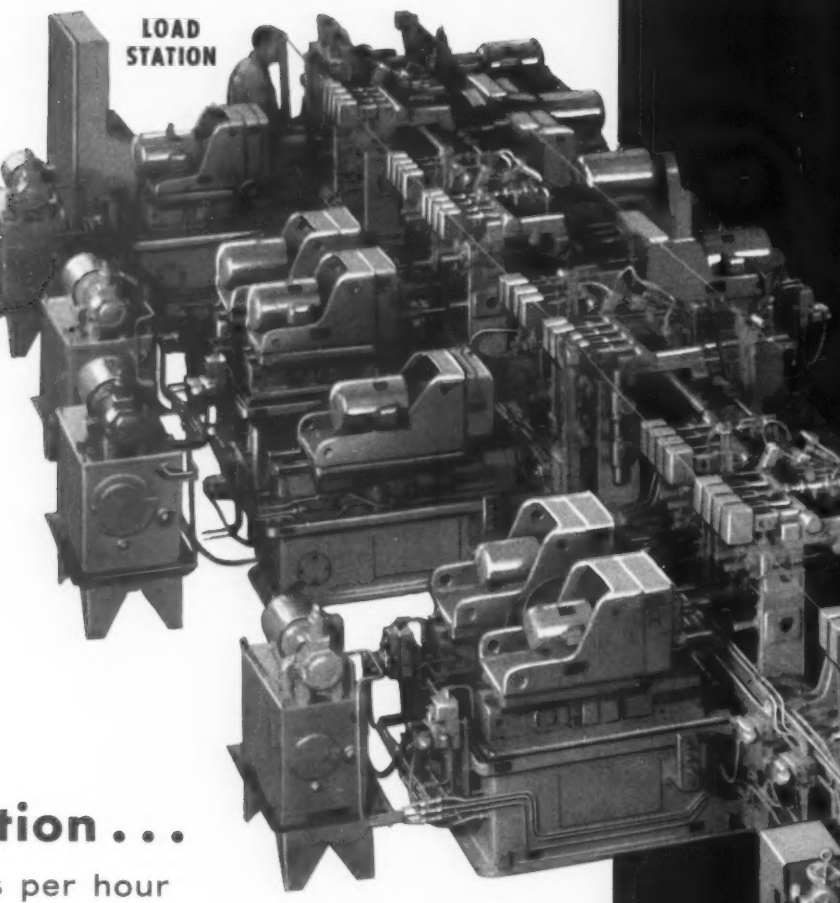

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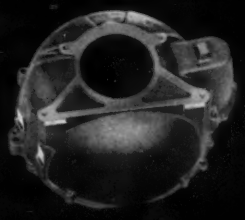
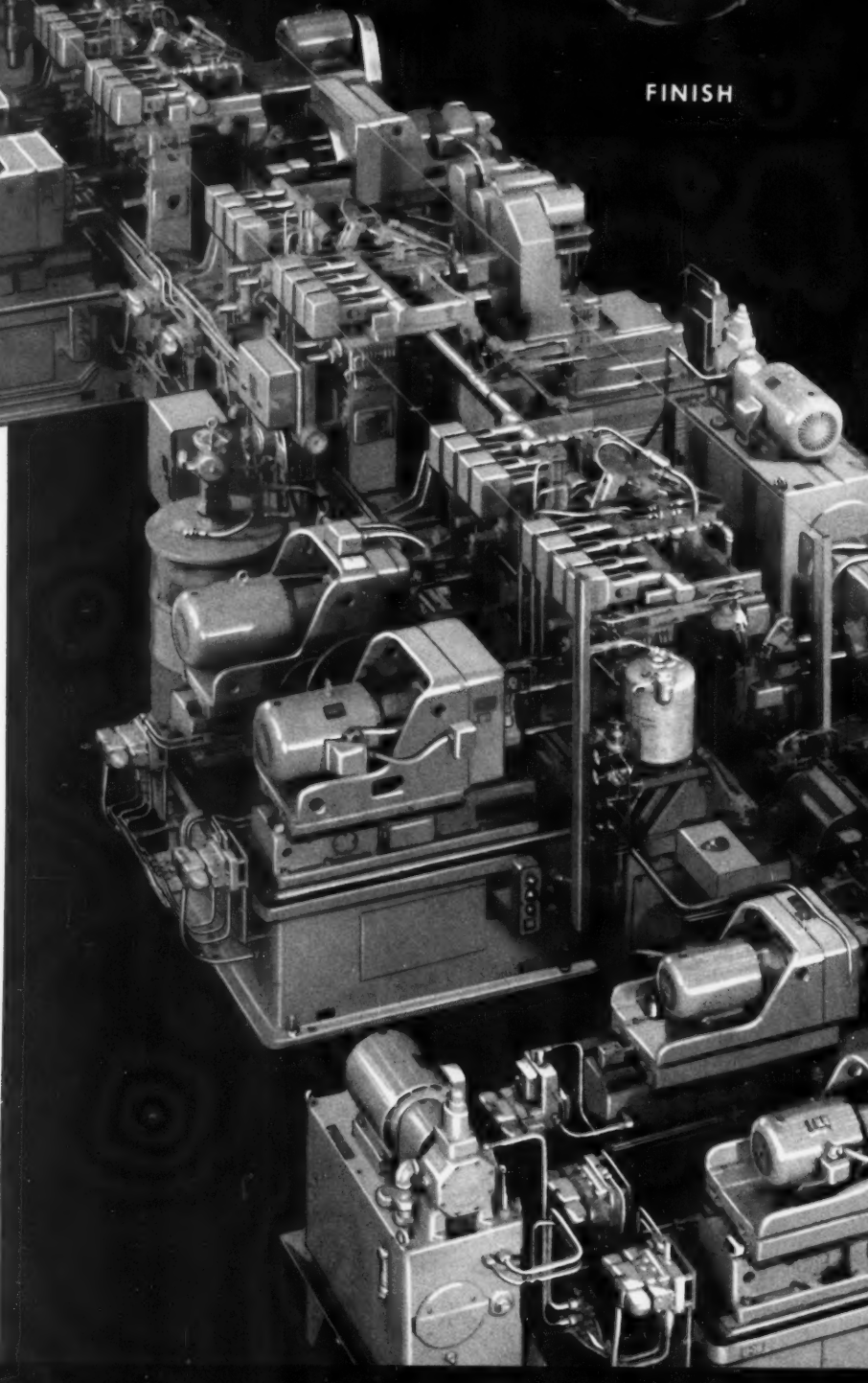


FINISH



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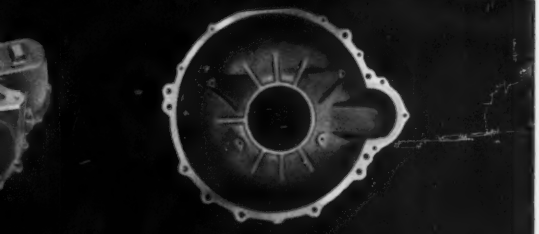
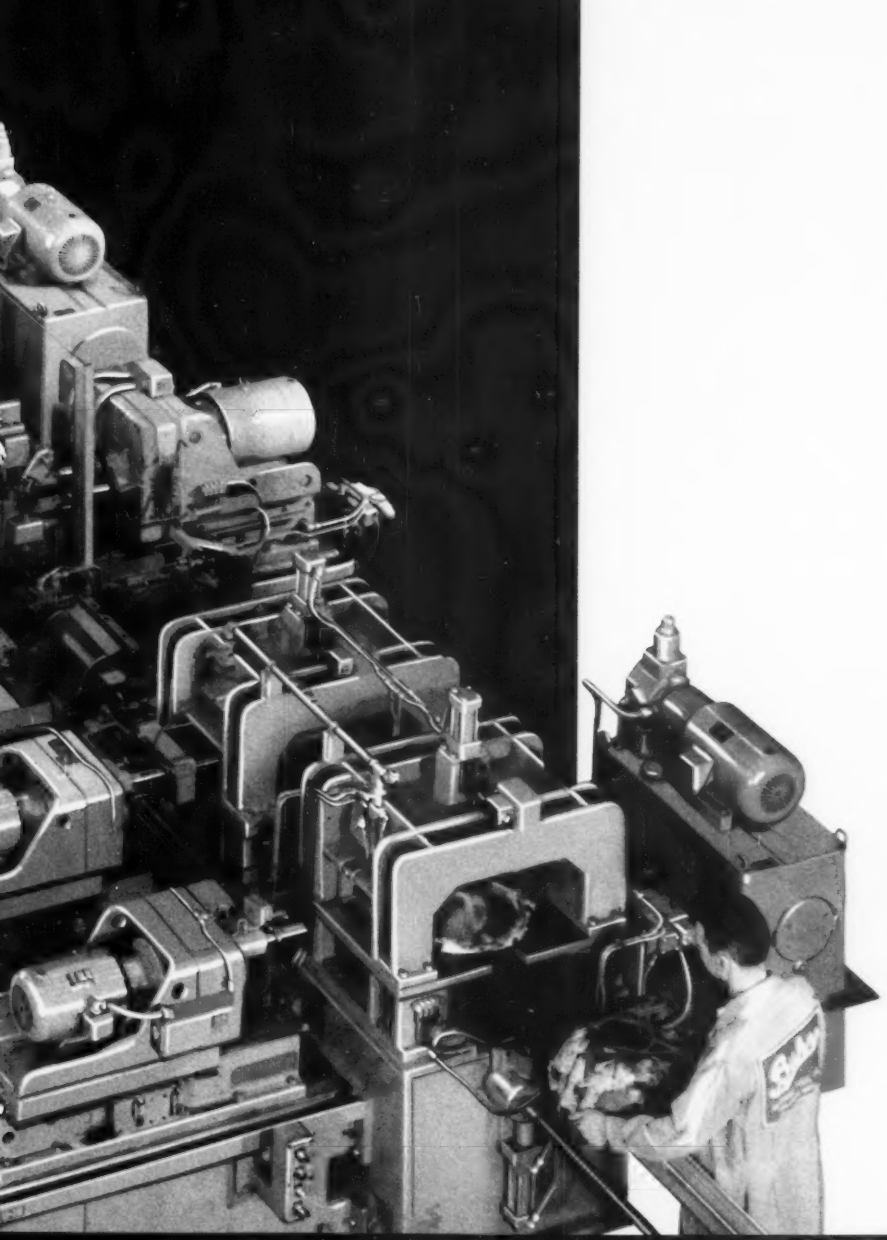
BUHR
ECONOMATIC

ue converter housing



FINISH

performs 90 operations each on two different converter housings . . . 27 drilling, 15 chamfering, 17 tapping, 3 milling, 3 rough-boring, 3 precision-boring, 3 precision-gauging and 15 probing



pace-setting featur

ADAPTABILITY . . . Buhr pioneered i ability of bases and parts, plus the clean design ample areas between stations (as may be noted left). This means 3-way economy—easier adaptat changes, easier maintenance and less down-time.

INTERMITTENCY . . . takes either of two ho uncommon hole-locations and processes them int

BI-METAL ACCOMMODATION . . . ea head is equipped with change-gear boxes for acco either cast iron or aluminum parts!

standard features

- automatic lubrication of all moving parts
- mist-lubrication to all spindles to maintain un perature in heads
- all spindles arranged for pre-setting of cuttin minimize downtime for tool changes
- hardened-and-ground automatically-lubricated
- standard and special parts interchangeable f maintenance
- J.I.C. Standards throughout

BUHR MACHINE TOO

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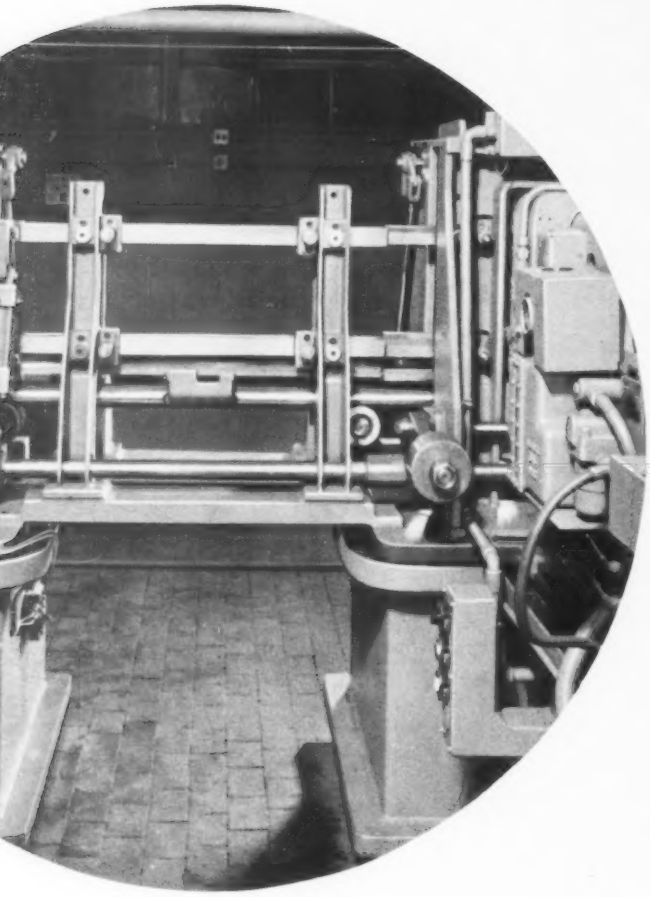
Solidly Engineered • Precision Built • for World's Leading



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setting the pace in production adaptability

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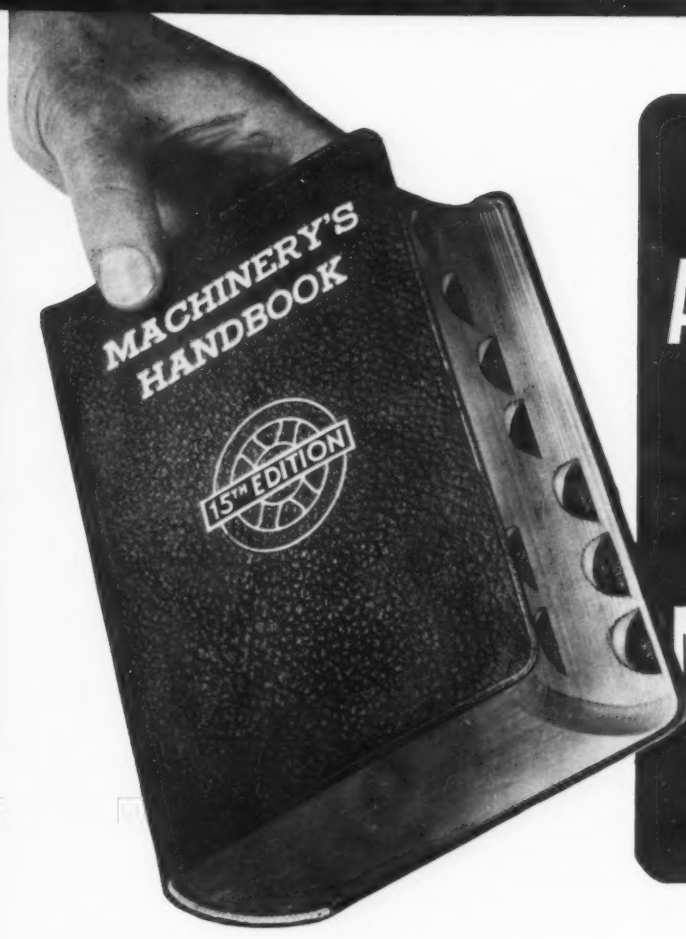

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For forty years . . . through fourteen editions . . . with over a million copies sold, MACHINERY'S HANDBOOK has been the indispensable reference book for designers and builders of mechanical products. Now the 15th Edition, with over 400 pages revised and brought up to date, gives you the latest and most authoritative information on present-day designing, manufacturing and metalworking practices.

Practical Information for Every Shop Man

A modern handbook is a necessity for every man who holds or hopes to hold a responsible job in the mechanical industries. Shop men, as well as engineers and designers, find MACHINERY'S HANDBOOK invaluable. It contains the kind of information that is needed wherever machines, tools, and mechanical devices are designed or constructed.

MACHINERY'S HANDBOOK contains 1911 pages of mathematical and mechanical tables, rules, formulas and general data (see complete table of contents on page 3). Its "math" and other tables never subject to change are accurate to the last decimal point, because Handbook users all over the world have been checking them for 40 years.

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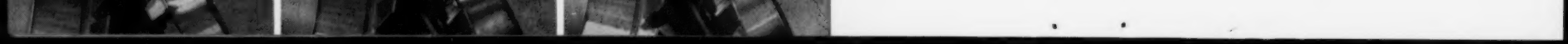
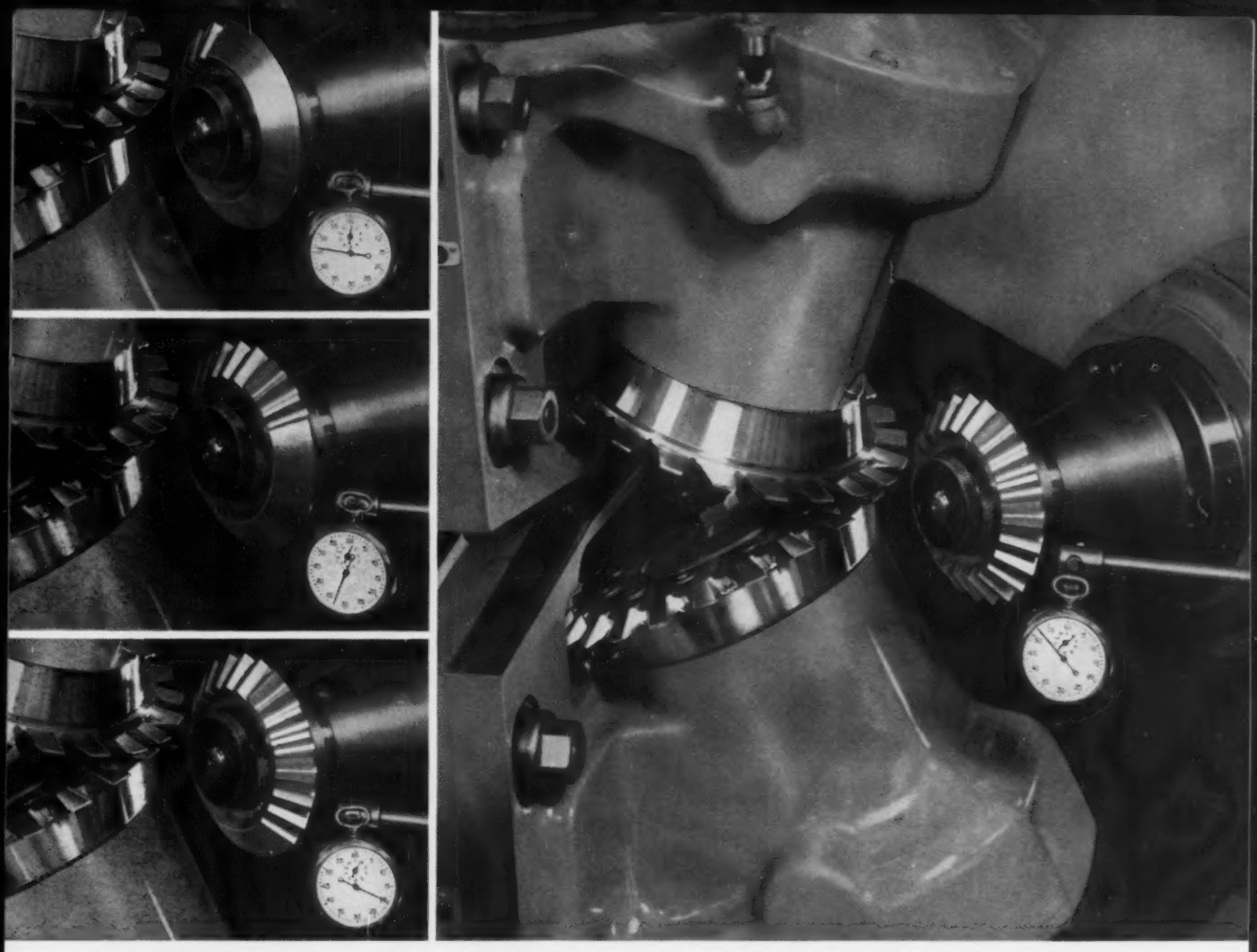




3 minutes-52 seconds, completed from the solid

You can cut gears 5 times faster!

You can increase production by as much as 400%.

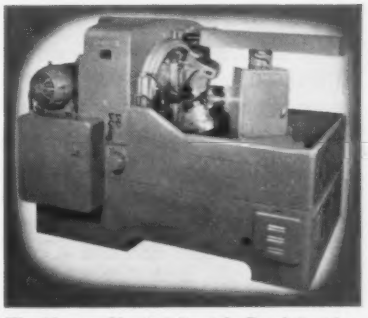
Your exact gain may vary with different gears, but in most cases this new generator will complete five gears in the time earlier models cut just one. The illustrations above show a 6 DP, 25 tooth, 7/8" face width, straight bevel gear completed from the solid blank.

The No. 104 Straight Bevel Coniflex* Generator completes each tooth in one rapid operation. A pair of multi-blade disc-type cutters combined with a cam-controlled machine cycle insures high efficiency, fine finish and maximum cutter life.

Easy to set up, the No. 104 has a wide range of capacity. You'll get the same excellent results for both small quantity jobbing work and volume production.

To discover other savings you can make with this remarkable Gleason Generator, simply write for descriptive bulletin.

*Coniflex® straight bevel gears with localized tooth bearings.

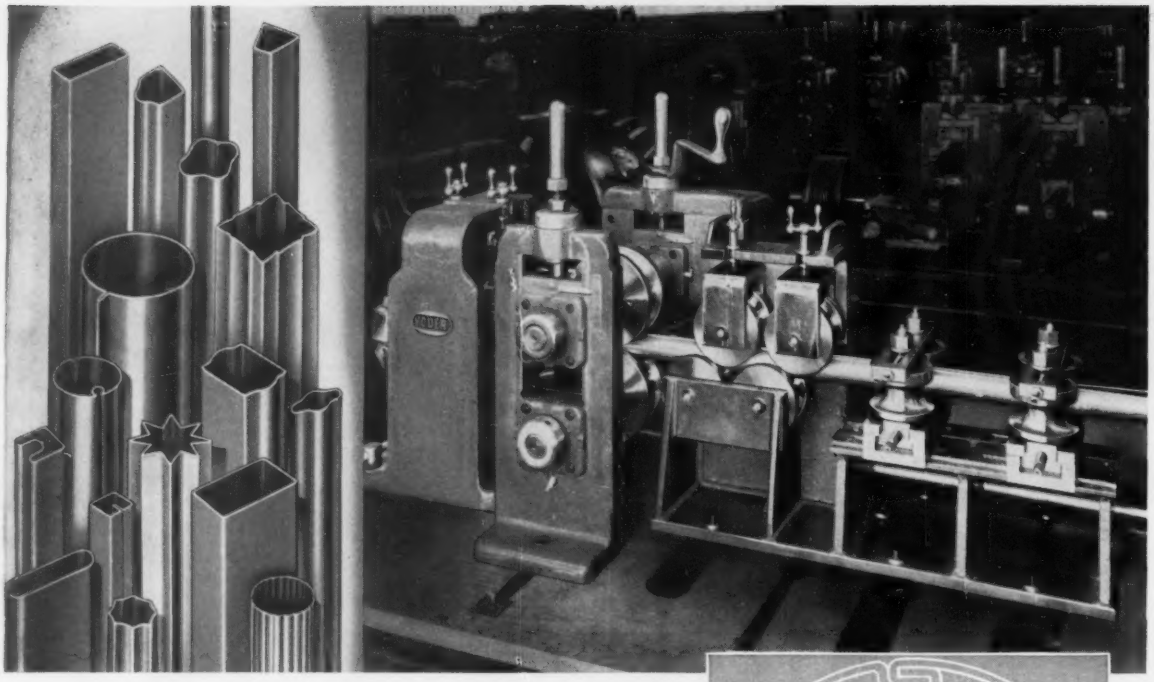


The Gleason No. 104 Straight Bevel Coniflex Generator cuts gears up to 8½" diameter, 4½" cone distance and 1⅜" face width, from 20 to 3 DP, ratios up to 10 to 1.

GLEASON WORKS

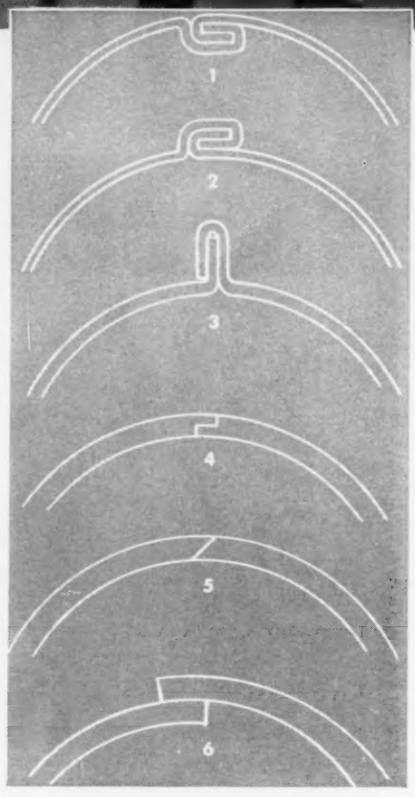
Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.



Lock-Seaming attachment at exit end of forming machine.

COLD ROLL FORMING TUBULAR SHAPES



Among the wide variety of things you can make on a Yoder Cold Roll Forming machine are round, square, oval, rectangular and other tubular shapes, such as illustrated at left above. The seams may be open, lapped, butted, dovetailed, interlocking, etc.—as indicated in Figures 1 to 6 at the right.

Millions of feet of such unwelded tubular shapes are made from coiled strip for conductor pipe, bedsteads, lamp stands, window channel, wiring raceways, carrying rods, etc. Production ranges from 20,000 to 50,000 feet per day, with only one operator and a helper.

Yoder offers you the cooperation of their engineering staff for designing and adapting their cold roll forming machines, auxiliaries, and tooling, for the low cost production of structurals, mouldings and trim, panels, tubular and other shapes, to meet individual needs.

The Yoder book on Cold Roll Forming is a complete, illustrated text on the art and the equipment needed for performing a variety of operations which can be combined with cold roll forming, at little or no extra labor cost. A copy is yours for the asking.

THE YODER COMPANY
5504 Walworth Avenue **Cleveland 2, Ohio**

ENGINEERING **YODER** MANUFACTURING

COLD ROLL FORMING MACHINES
PIPE AND TUBE MILLS (ferrous or non-ferrous)
ROTARY SLITTING LINES

Form tool maker reports Norton Grinders...

grind better for less money

MORGOOD TOOLS, INC.
Tools for Automatic Screw Machines

• 381 BUELL ROAD
• P. O. BOX 7 - THURSTON RD. SUBSTATION
• ROCHESTER 19, NEW YORK

February 6, 1957

Norton Company
Worcester, Massachusetts

Gentlemen:

Your #1 Tool and Cutter Grinder has proven to have outstanding qualities for grinding circular form tools.

The low initial cost, low maintenance and high accuracy and finish is most beneficial. Graduations on the longitudinal table feed permits rapid and accurate cuts, which facilitate minimum time used in optical measurements. Due to the replaceable heavy cartridge spindle it is possible to make heavy cuts and still retain the desired accuracy and finish after many years of use.

We are very pleased with the record performance of these machines which enable us to furnish the highest finish in our trade.

Cordially yours,

MORGOOD TOOLS, INC.

BJG/bjc

Ben John Goodman

At Morgood Tools, Inc., Rochester, N.Y., a large manufacturer of circular form tools, nine Norton No. 1 Tool and Cutter Grinders have beaten all previous records for efficiency and economy in finish grinding.

The Norton No. 1 Universal Tool and Cutter Grinder is a completely motorized machine that can be supplied in various arrangements — from the simple sharpening of cutters and reamers supported on centers only, to suitability for all sorts of cutter, surface, cylindrical and internal grinding.

Each arrangement has valuable advantages. For example, longitudinal table feed by means of a feed screw and handwheel — instead of competitive methods of using length rods and dial indicators — is ideal for speed and accuracy in circular form tool grinding.

Only Norton offers you such long experience in both grinding machines and wheels — to bring you the "Touch of Gold" that helps you produce more at lower cost.

For further information, see your Norton Representative. Or write for Bulletin 1034 to NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION:
Coated Abrasives • Sharpening Stones • Behr-cat Tapes

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit

For more information fill in page number on Inquiry Card, on page 229

At Brown & Sharpe

Natcos Help From

At Brown & Sharpe, a 22-spindle Natco 3-way Machine handles finished drilling, boring and reaming on "00" screw machine beds

NATCO

Slash In-Process Time 16 Weeks to One Week

On Automatic Screw Machine Beds

Even on precise machine tool parts, traditionally handled on a "job-shop" basis, Brown & Sharpe gained great advantage by installing an automatic line. Prominent in the line are two Natcos, engineered and tooled to handle all drilling, boring and reaming on either the No. 00 or No. 2 automatic screw machine beds.

One Natco does all roughing—the second handles finishing. Total of 62 operations. Each Natco is tooled to process two parts at once—tooling is interchangeable to accommodate either sized bed.

Extreme machine tool accuracy must be maintained throughout. In one operation the Natco drills through five walls, holding centers parallel to the locating surface within .0015" for the full 42" distance. In another case, Natco engineering devised a tooling leaf that automatically drops through a core in the part, providing internal boring bar support.

Natcos make sense even on "job-shop" jobs. Call in a Natco Field Engineer—he can quickly tell you whether a Natco can be a cost-saver on your next job.

National Automatic Tool Company, Inc.

Richmond, Indiana *Multi-spindle drilling, boring, and tapping machines. Special machines for automatic production.*
Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

ARMSTRONG
WRENCHES

Types and Sizes for Every Industrial Use

ARMSTRONG Wrenches have engineered designs, a wide safety factor of extra strength, accurately machined openings that go over screw heads or nuts easily, grip firmly —will not slip, round corners or mar faces.

Drop forged from special high tensile carbon and alloy steels, heat treated to an exactly pre-determined balance of hardness, toughness and tensile strength. ARMSTRONG Wrenches will not "chew out," will stand up through years of service, making work faster, easier and safer.

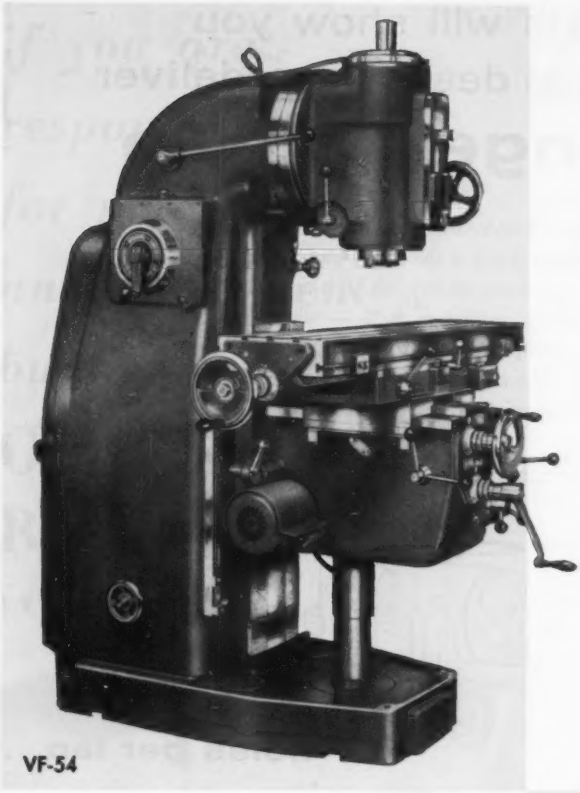
In sizes and types, ARMSTRONG Wrenches comprise the most complete line of industrial wrenches manufactured. Specify "ARMSTRONG" when ordering wrenches.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for Catalog

ARMSTRONG BROS. TOOL CO.

5213 W. ARMSTRONG AVE. • CHICAGO 30, ILL.



VF-54

ONLY SWEDISH CRAFTSMEN

Can Build These Precision Millers At Such Surprisingly Low Cost

HORIZONTAL AND VERTICAL SAJO MILLERS

Built to U.S. Standards, Sajo Millers with proven production records in modern industry are available in both plain and universal models. Installation references in your vicinity on request.

Standard Duty #2 (Model 54)
ALL GEARED Millers—

Plain, Universal and Vertical—table 52" x 11", 7½ HP with power feeds (longitudinal 33½") and power rapid traverse.

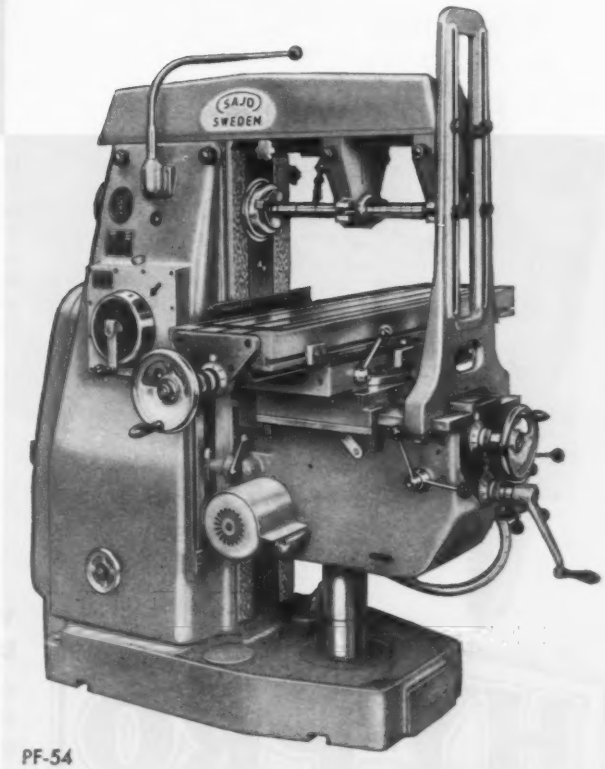
•

Light Duty #2 (Model 53)
ALL GEARED Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

Light Duty #2 (Model 48)
Utility Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").



PF-54

austin INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

HORIZONTAL AND VERTICAL SHAPERS • POWER HACKSAWS

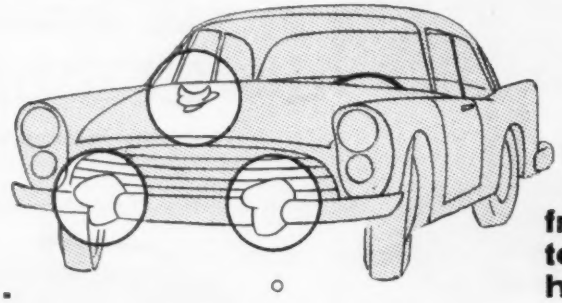
FAST SERVICE AND PARTS AVAILABLE FROM MAJOR CITIES, WRITE FOR CATALOGS

For more information fill in page number on Inquiry Card, on page 229

HY-PRO specialists will show you how a little difference in design can deliver

100 times longer tap life

The jobs where tap life can be increased a hundredfold are obviously exceptional, but it *can* happen, as these cases prove, even in the cost-wise automobile industry. That's why it pays to question tap costs on any job. Job analysis by HY-PRO specialists *regularly* leads to savings as high as 50% — with special taps when required — but often with a simple switch to the right style of standard taps. Why not find out if your tap costs are low as they can be? It costs nothing to consult the HY-PRO specialists.



from 100 to 10,000 holes per tap...

The standard spiral point tap formerly used for tapping an automobile bumper bracket lasted for 100 holes or less, due to breakage. The cause was misalignment which could not be corrected without prohibitive expense for jigs, and for special controls in preceding operations. HY-PRO specialists designed a no-flute, 3-spiral groove tap with special heat-treatment which boosted production to 10,000 holes per tap — with no change in job conditions. Result . . .

98% SAVINGS in tap cost

from 25 to 10,000 holes per tap...

In a tapping operation on a die cast automobile ornament, the standard 3-flute tap being used broke after an average run of 25 holes. The cause was spalling and binding of the relatively soft alloy around the tap. HY-PRO specialists recommended an oversize 3-flute plug point tap with minor flute modifications. Binding was eliminated, and clean cut threads permitted easier assembly. Production was increased to 10,000 holes per tap. Result . . .

99% SAVINGS in tap cost

HY-PRO

REG. U. S. PAT. OFF.

The Tap Engineering Specialists

Why "special" tap development brings you better "standards"

Even though you never need "specials", you benefit by HY-PRO leadership in special tap design. The intensive research and testing involved is all reflected in constant improvement of HY-PRO standard taps. HY-PRO specialists can often point out opportunities for substantial savings, even in tapping operations you've considered satisfactory. For information, write: Dept. E.

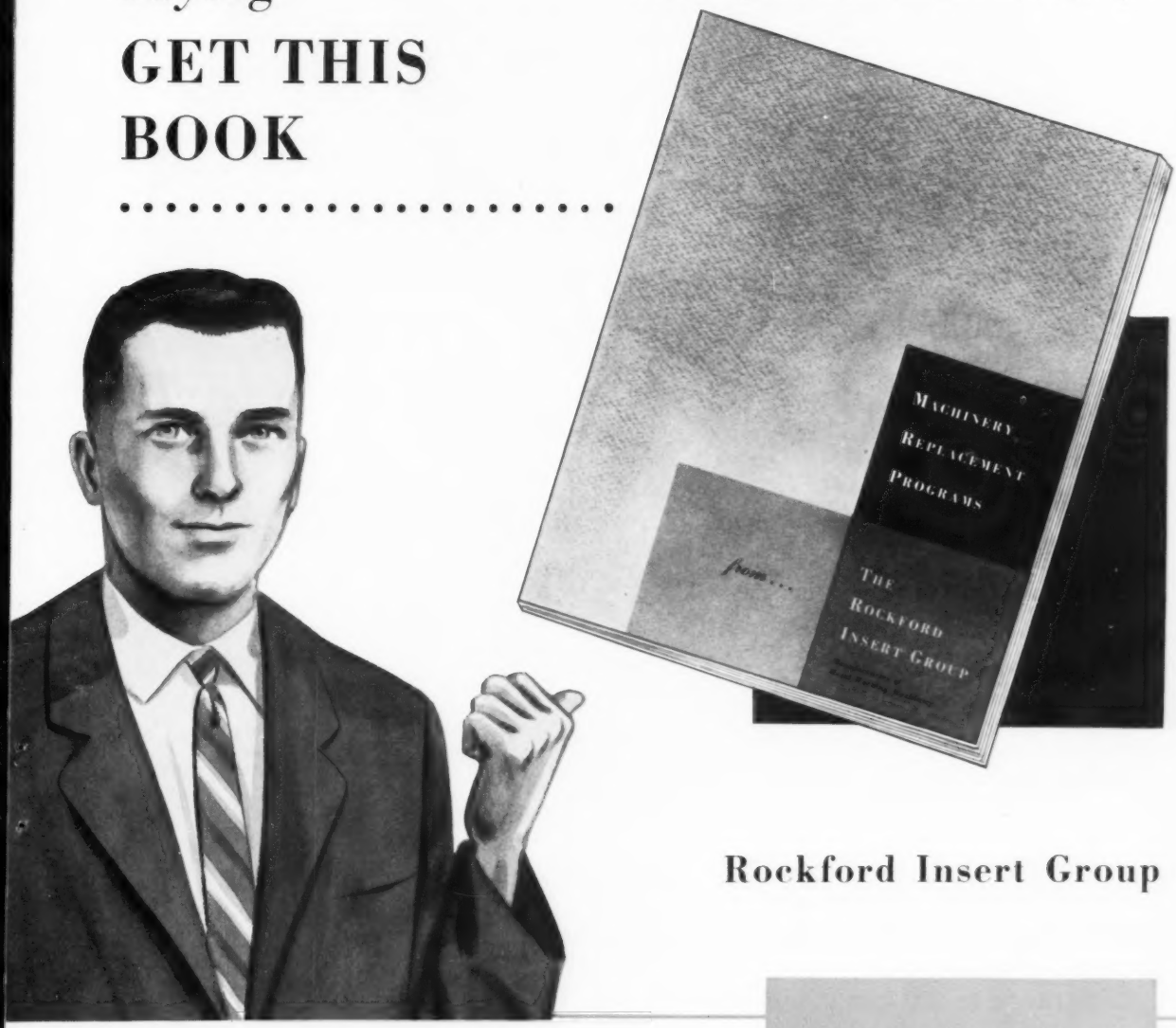
ASK FOR STOCK LIST OF SPECIAL TAPS AVAILABLE FOR IMMEDIATE DELIVERY

CALL YOUR LOCAL **HY-PRO DISTRIBUTOR** FOR STANDARD TAPS FROM STOCK
HY-PRO TOOL COMPANY • NEW BEDFORD, MASS., U.S.A.

if you are responsible for machinery and equipment buying

GET THIS BOOK

Eighteen prominent industrialists discuss their machinery and replacement programs in this book. This valuable information represents the most up-to-date collection of evidence of the importance of such programs in industry today. For your free copy, merely write to any one of the companies in the Rockford Insert Group.



Rockford Insert Group

A word about the Beloit College Seminar

Arrangements have been finalized for MAPI's third annual Summer Seminar on Dynamic Equipment Policy to be held the week of July 7, 1957, at Beloit College, Beloit, Wisconsin. This year, in addition to the usual intensive course in the theory and practice of equipment analysis, MAPI Research Director George Terborgh will discuss in detail his expanded and generalized approach to business investment policy. Based on the same general principles as *Dynamic Equipment Policy*, this reformulation makes available broadened and improved applications of the MAPI "formula."

For further information on the Seminar, write the Machinery and Allied Products Institute, 1200 — 18th Street, N. W., Washington 6, D.C.

Keep gathering metal working production ideas... be well informed when you replace machinery

June, 1957

speeds for carbides **plus** heavy-cut efficiency

low range to 100 fpm . . . for extreme depths of cut and maximum feeds

medium range to 150 fpm . . . for average cuts in medium steel or cast iron

high range to 300 fpm . . . for carbide planing of steel and non-ferrous metals

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

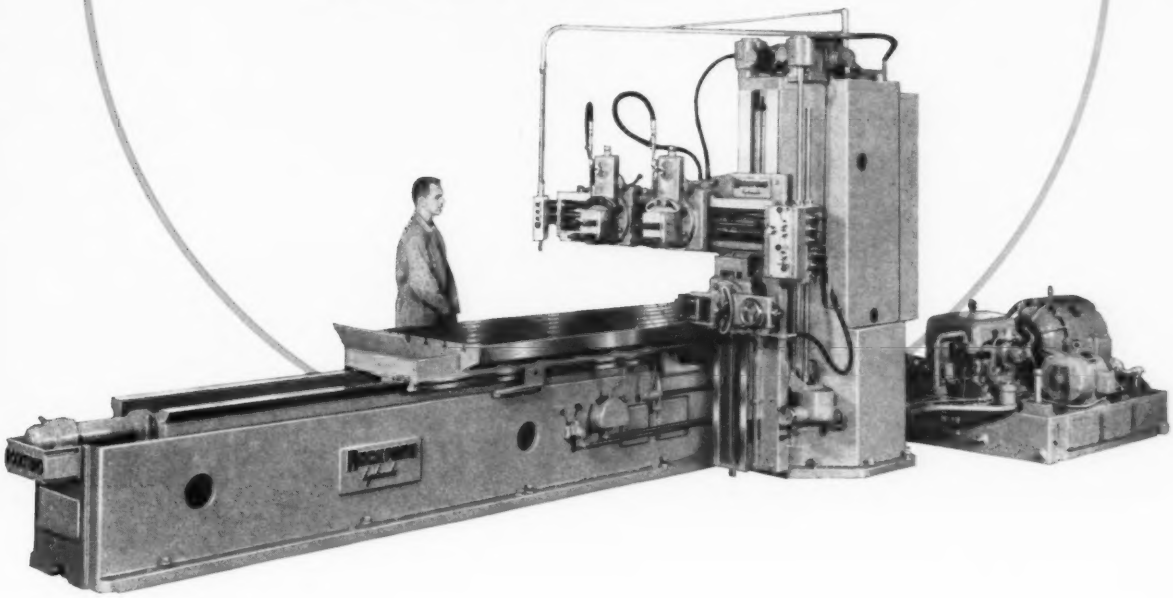
CATERPILLAR

with triple circuit h3 drive

The new heavy duty Model OGN Hydraulic Shaper-Planers are equipped with triple circuit h3 drive to combine the ruggedness and cutting efficiency of single circuit planers, with the speeds required for carbide planing. Three distinct ranges of cutting speed are provided, with power inversely proportional, to give the correct combination of speed and force to most economically machine any metal.

Hydraulic drive is ideally suited for carbide tooling, since optimum cutting speeds can instantly be set for any tool. Tools also enter the cut more smoothly with hydraulic drive to reduce the tendency for fracturing brittle carbide tips.

A Rockford Machine Tool Co. representative can demonstrate these advantages for you. Ask your local dealer for full details, or write us for a copy of Bulletin No. 1200.



ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

HYDRAULIC

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CATERPILLAR

proves...

good reamer design helps hold size

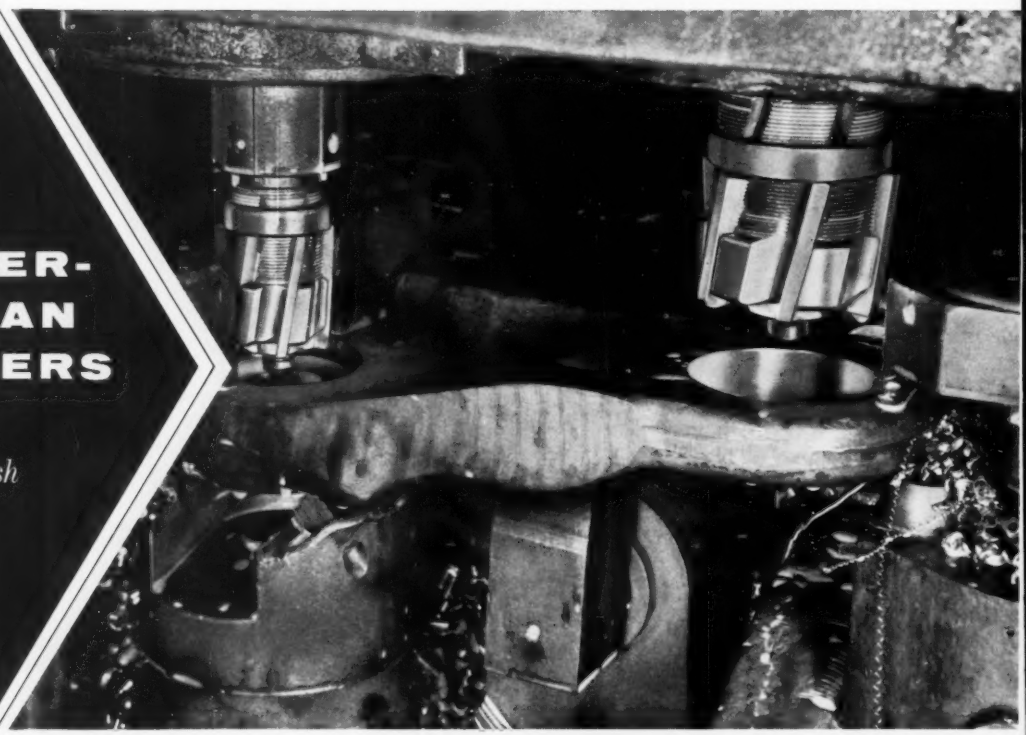
and

tool life in tough materials

BARBER-COLMAN REAMERS

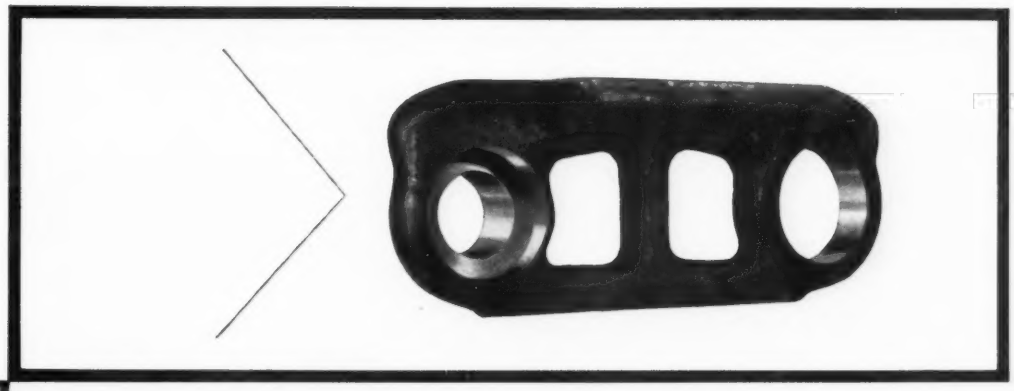
provide

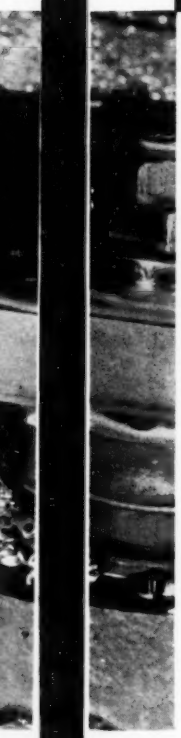
required finish
and
production



Machinery, June, 1957

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**





Caterpillar Tractor Co. finish reams 2 holes in these tough forged steel track links with the required surface finish and a production rate of 102 pieces per hour from each machine. Previous operations include core drill and rough ream the large hole, and core drill and counterbore the small hole. Four hundred pieces are obtained per sharpening in this tough, hard material. Finish reaming is used because it is the only means available which will produce the required finish and meet the high production requirements of this job.

these are the job facts:

Bore Size	2.605"	1.738"
Stock Reamed	.025"	.025"
Cutting Speed	75 rpm.	100 rpm.
Production	102 per hr.	102 per hr.
Feed	.011" per rev.	.013" per rev.

These Barber-Colman reamers were specially designed to suit the requirements of this part. The design of the reamer body provides maximum backing for the cutting edge and a large chip space in front of the blades to insure good chip flow.

The direction and angle of spiral are designed to provide the most efficient cutting action in this material. The reamer body is specially heat treated for toughness. These reamers are sharpened with a positive primary clearance. The nose form includes a chamfer, lead, and straight portion which are specifically designed for the job. Behind the nose, a back taper provides adequate clearance in the finished hole. These elements of the profile are accurately maintained by cam-controlled sharpening on the Barber-Colman Combination Sharpening Machine.

When you have hole finishing problems involving accuracy, finish, tool life and production requirements, call a Barber-Colman reaming expert and talk over with him the most economical way to get the results you want.

BARBER-COLMAN COMPANY

926 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

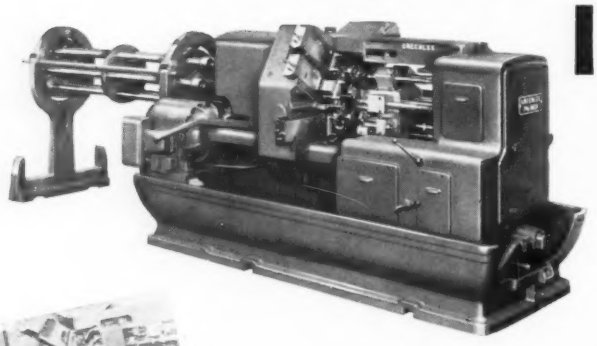
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

You get

1. Simplified cross-slide camming
2. Interchangeable cross-slide tool holders
3. Quick-adjusting stroke mechanism
4. Rapid speed and feed changes
5. Wide-open, easily reached tooling area
6. Built-in threading feed and drive
7. Easily accessible main toolslide holders
8. Stationary type collets changed quickly

eight big reasons why you get *Fast Setups* on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits



PRODUCTION MACHINERY
GREENLEE

4-SPINDLE...6-SPINDLE
SECOND-OPERATION
PNEUMATIC STOCK FEED

WRITE TODAY
FOR CATALOG
A-405

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1866 Mason Avenue
Rockford, Illinois

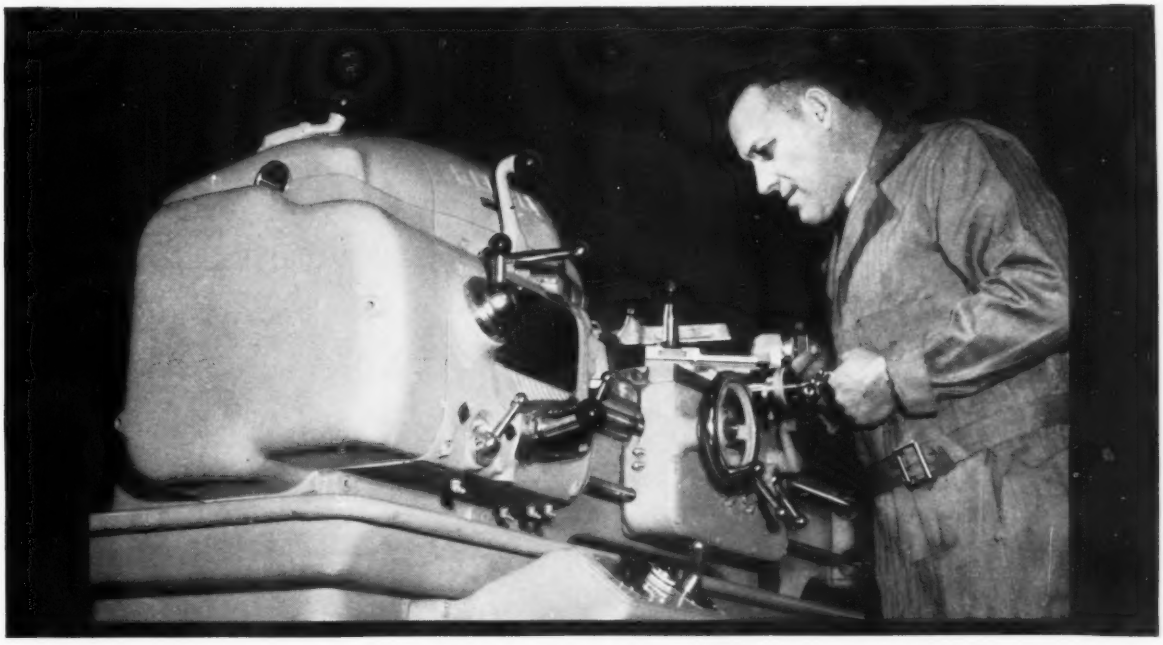
CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

You get

top value per dollar

with a Hendey 9" Lathe

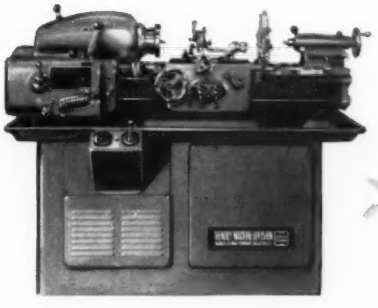
efficient operation on precision, high-speed lathe



Looking for a high-precision lathe with speeds that take advantage of carbide tooling? If you are — take a good look at the Hendey 9-in. x 24-in. tool and gage-makers' lathe. Compare it with any other lathe in its class on moderate-run production jobs, as well as on the toolroom operations where its reputation was made.

Maximum operator convenience is assured by compact control grouping. Carriage, slide, and compound combine precision with rigidity in machine's construction.

Spindle speed — infinitely adjustable from 15 to 3000 rpm — may be changed smoothly and easily while under load. Rapid stopping of the spindle, even while operating at maximum speed, means shorter floor-to-floor times since there is no waiting for machine to coast to a stop. Efficiency can be improved further on many production turning jobs by using optional accessories like the four-way tool block and taper attachment. Ask your nearby Hendey dealer about the complete facts and features.



for precision with production buy Hendey

Hendey **machine division**

BARBER-COLMAN COMPANY

62 Loomis St., Rockford, Illinois

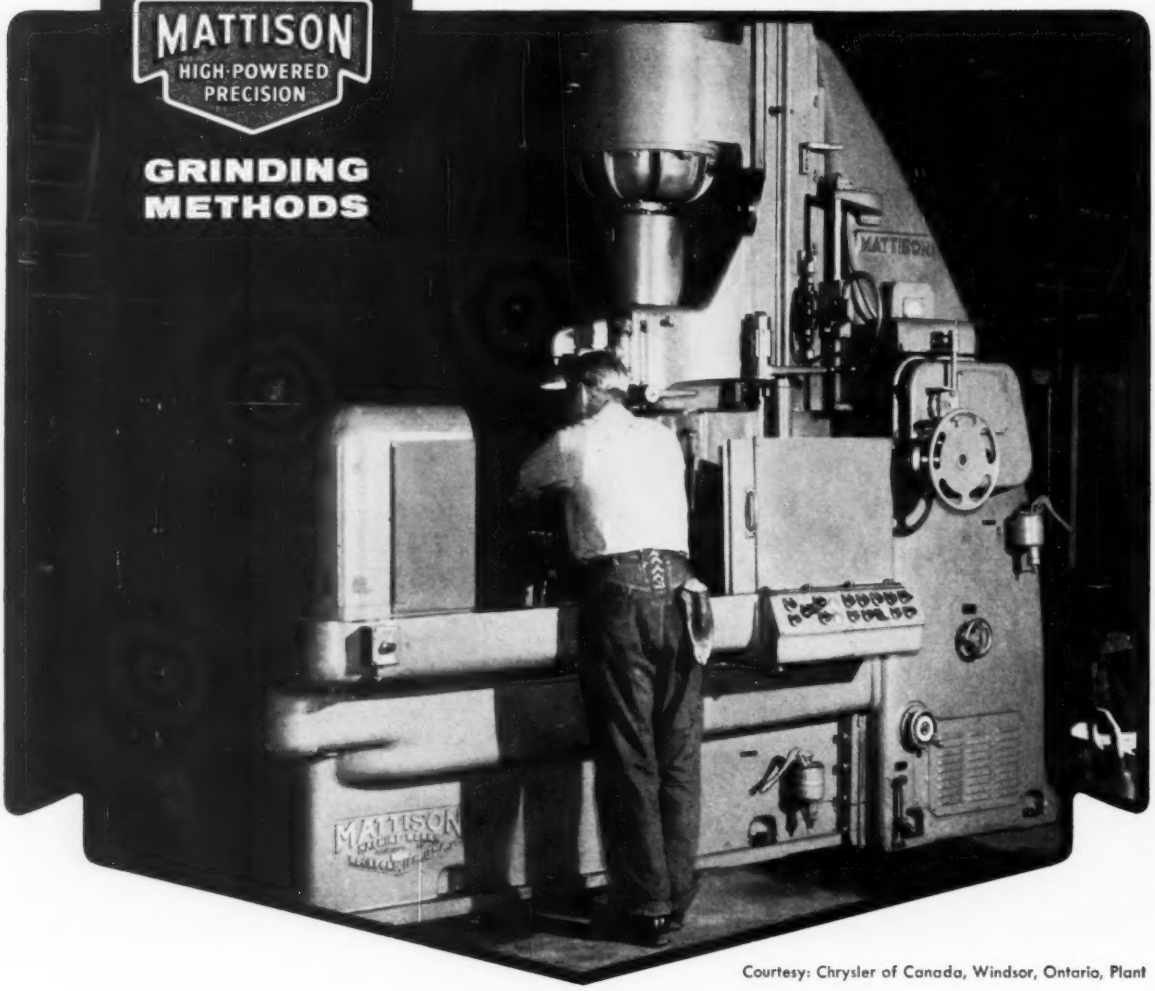
BARBER COLMAN ®

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED
PRECISION

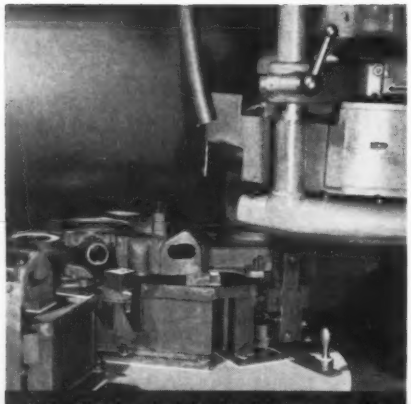
GRINDING METHODS

CASE HISTORY NO. 36—CHAIN CASE COVERS



Courtesy: Chrysler of Canada, Windsor, Ontario, Plant

Three different surfaces on chain case covers ground at 13 per hour



In the Chrysler plant, the No. 36 removes up to ⅛ in. of stock while holding parallelism to .001 in. and accuracy to .002 in.

Power and rigidity of the Mattison No. 36 Vertical Rotary Surface Grinder pay off on this heavy stock-removal job at Chrysler of Canada's new Windsor, Ontario, motor plant. Three faces of heavy cast iron chain cases are ground in one setup . . . achieving a production rate of 13 cases per hour, each ground on three different surfaces.

The table passes the cases under the wheel at the rate of 30 rpm. Wheel speed is 900 rpm and downfeed is .060 in. per minute. Automatic sizer checks each piece as it leaves the wheel and corrects feed accordingly.

Quality was one of the deciding factors in the selection of machinery for the new Chrysler plant. Like many other manufacturers, Chrysler has found the No. 36 Vertical Rotary's integral column-and-base construction, extra power, and exclusive functional design enable it to use modern, improved grinding wheels effectively . . . and profitably. For full details ask for Bulletin No. 146-4RM.

IF IT'S A FLAT SURFACE THERE IS A MATTISON TO GRIND IT

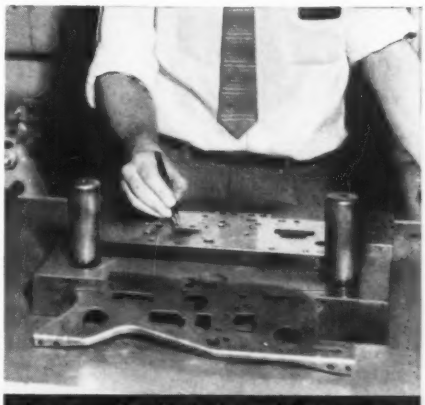
CASE HISTORY NO. 41—DIE SHARPENING

Courtesy: Teletype Corporation, Chicago, Illinois

Single setup sharpening of large dies cuts toolroom costs, reduces downtime

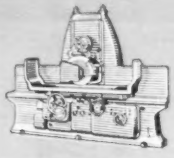
Here's how valuable production time can be saved by sharpening large dies on the Mattison High-Powered Precision Surface Grinder. In the Wrightwood plant of the Teletype Corp., Chicago, Ill., entire dies that were once sharpened section by section are now ground intact on this high-powered Mattison grinder . . . a reduction in setup time of up to 83 per cent. The wheel and spindle clearance of these Mattison machines makes it possible to sharpen the entire die without disturbing the lead pins. This means the die can go back to the press directly from the grinder, reducing press downtime.

Your Mattison dealer can arrange for a test grind of your toolroom or production parts in the Mattison Methods Laboratory . . . see him for full details.



Large blanking die is sharpened intact . . . note undisturbed lead pins. Stock removal, .005 in.; burr allowance, .002 in.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

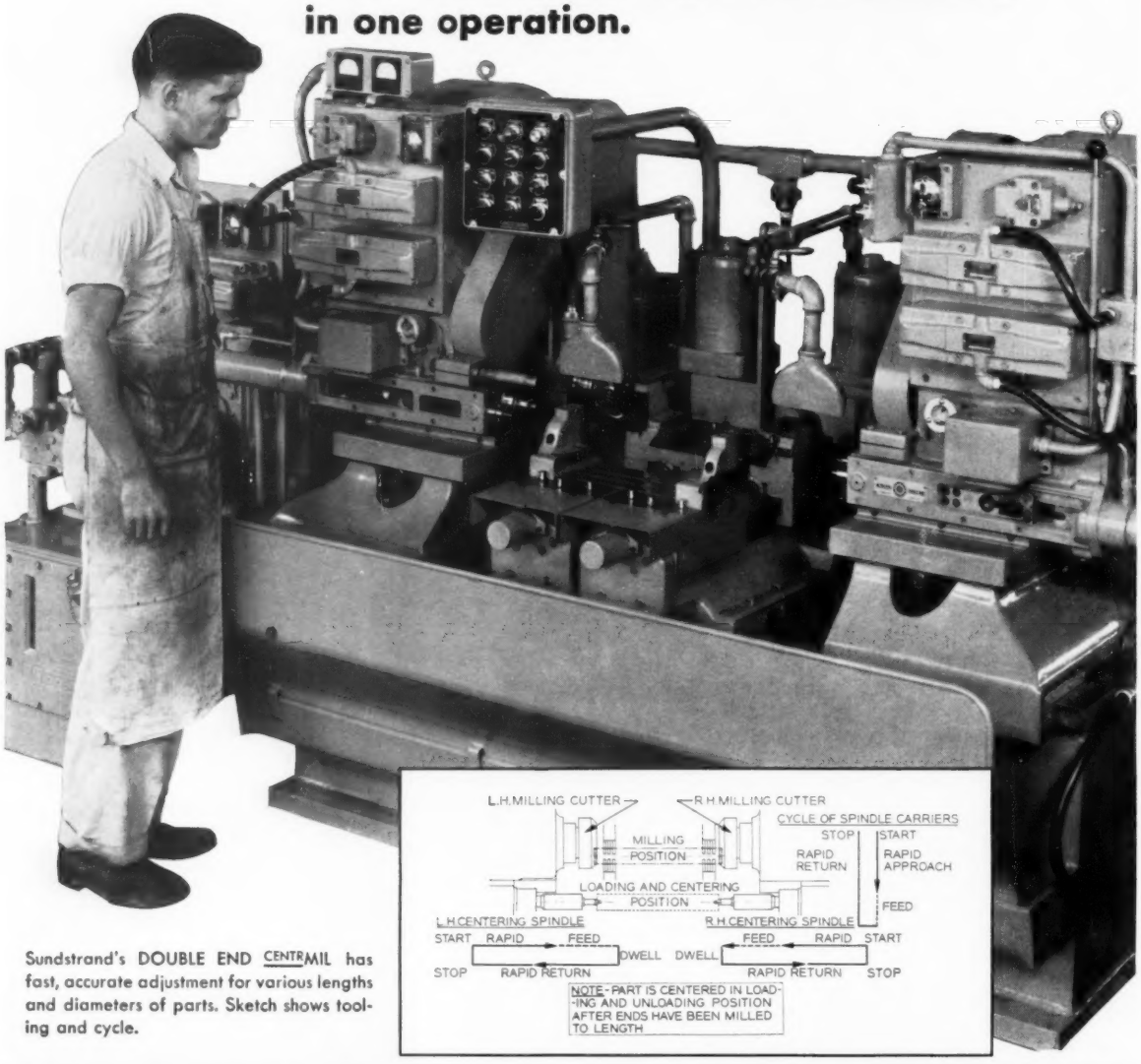


HIGH-POWERED
PRECISION
SURFACE
GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Prepare your shafts for MORE ACCURATE TURNING

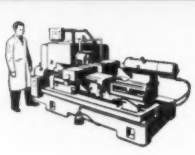
... by milling to length and centering in one operation.

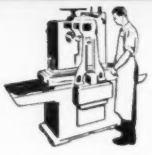


Sundstrand's DOUBLE END CENTERMIL has fast, accurate adjustment for various lengths and diameters of parts. Sketch shows tooling and cycle.

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Maintaining a definite relation between the ends and centers is automatically controlled on Sundstrand machines for squaring ends and centering shafts. This is of particular importance in preparing shafts for tracer turning. Combined milling and centering is more accurate than conventional methods as it isn't necessary to re-chuck the work between the milling and centering cuts, and the centers are held square with the end of the shaft. Combining the operations also saves the handling time and the floor space ordinarily required for a second or more expensive machine. In addition to being accurate, the CENTRMIL is fast. Three basic types, a SINGLE END CENTRMIL, a DOUBLE END CENTRMIL, and a DOUBLE END BROACHING and CENTERING MACHINE are available.

The DOUBLE END CENTRMIL has fast, easy adjustment making the machine ideal for both long and short parts in long or short runs. The automatic cycle of Sundstrand CENTRMILS can be combined with automatic loading and unloading for parts like automotive camshafts and similiar high production jobs.

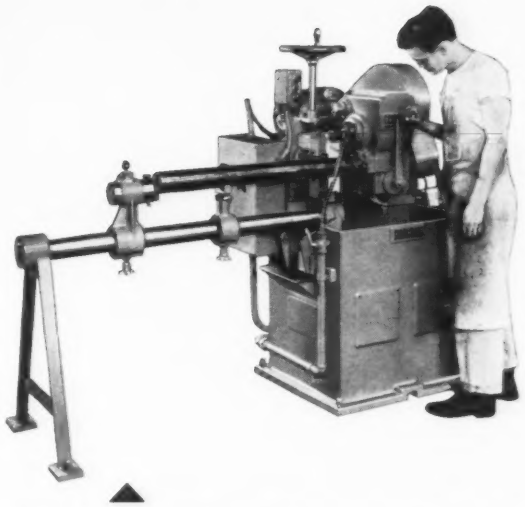
The SINGLE END CENTRMIL is ideal for the steel stock room or lathe department for miscellaneous small lot shaft work. Just a few simple adjustments and the machine is ready for individual pieces or small lots.

DOUBLE END BROACHING and CENTERING MACHINE provides the most practical machine for extremely high production. Low cost of tool per piece and high rate of production makes broaching the most economical method for high volume work.

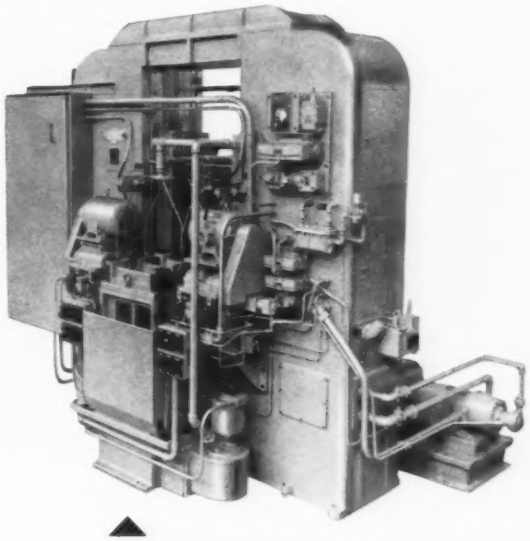
INCREASED PROFITS...

through improved accuracy and increased production are yours when you apply Sundstrand "Engineered Production" to your shaft work. More details are available in Bulletin 680.

WRITE FOR YOUR COPY TODAY!

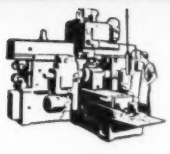


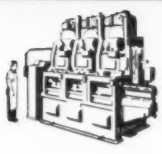
A typical example shows one manufacturer using a SINGLE END CENTRMIL, saving 65 out of 105 minutes on a lot of 40 pieces compared to previous method of facing to length and centering



BROACHING and CENTERING machine handles main transmission shaft forgings, two at a time, at the rate of 326 per hour.

TRIPLEX RIGIDMILS | **SPECIAL MACHINES**





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

"Engineered Production" Service

FOR BROACHING

It takes all 3

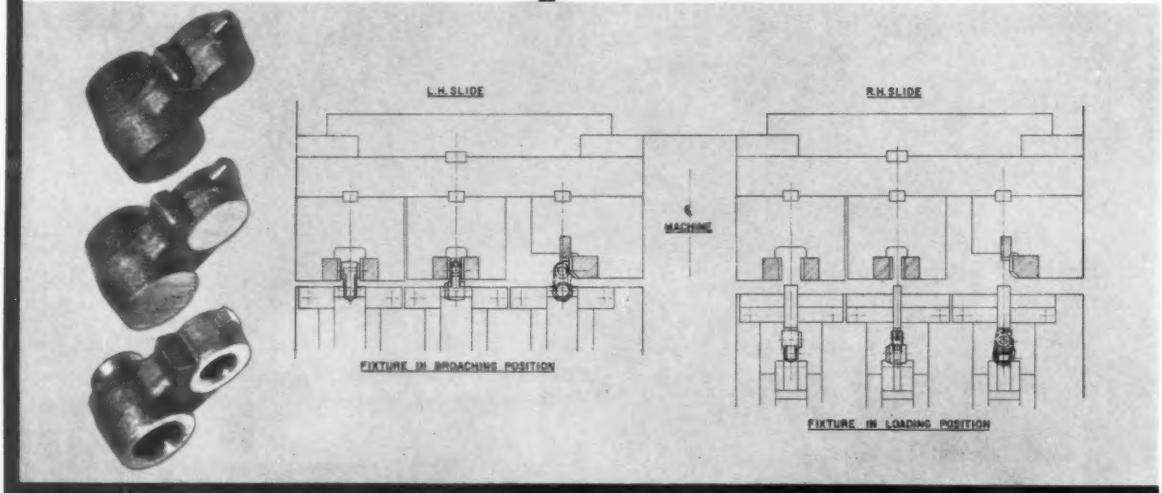
American's *"Engineered Production"* Service . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

THE JOB— Three operations required: (1) Straddle broaching hub ends; (2) Straddle broaching toggle pads; and (3) Broaching vee notch and end surface on pawl end of lever. Parts are forged SAE-1018 steel levers for transmission parking pawl toggles.

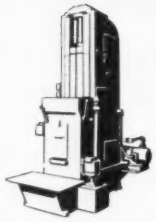
THE RESULT— 250 completed pieces per hour. Two hydraulically operated, tilting-type receding tables are used to hold six parts on a dual ram surface broaching machine.

1 PROPER BROACH TOOL DESIGN

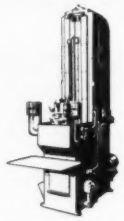
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish tolerances required, etc. High-quality work and long tool life result because broach and machine are designed to operate as a team. A single pass of either multiple tooled ram on this machine performs three different broaching operations on three parts.



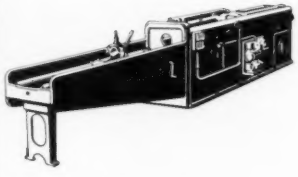
Broaching Tools



Three Way



Single Ram



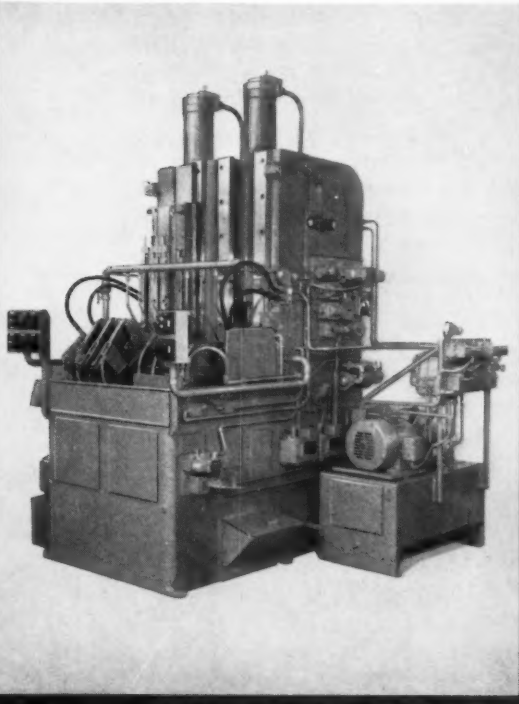
Horizontal

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

to give you peak broaching performance

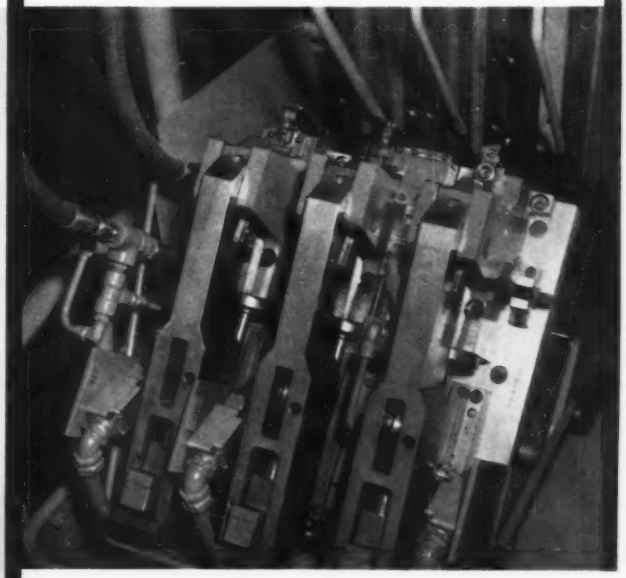
2 SPECIFYING THE RIGHT MACHINE

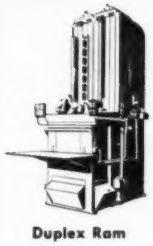
Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc. determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. The vertical hydraulic dual ram surface broaching machine shown, provides a separate hydraulic circuit for clamping, which is electrically interlocked with machine cycle for fast automatic operation.



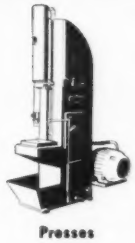
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Close-up, showing LH fixture only, has three parts in place ready to be broached. Fixturing on the RH ram is identical. One fixture is unloaded and loaded during the broaching stroke of the other ram, providing the most practical method. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.





Duplex Ram



Presses

For more information on practical broaching methods, write for Bulletin A615.

SUNDSTRAND

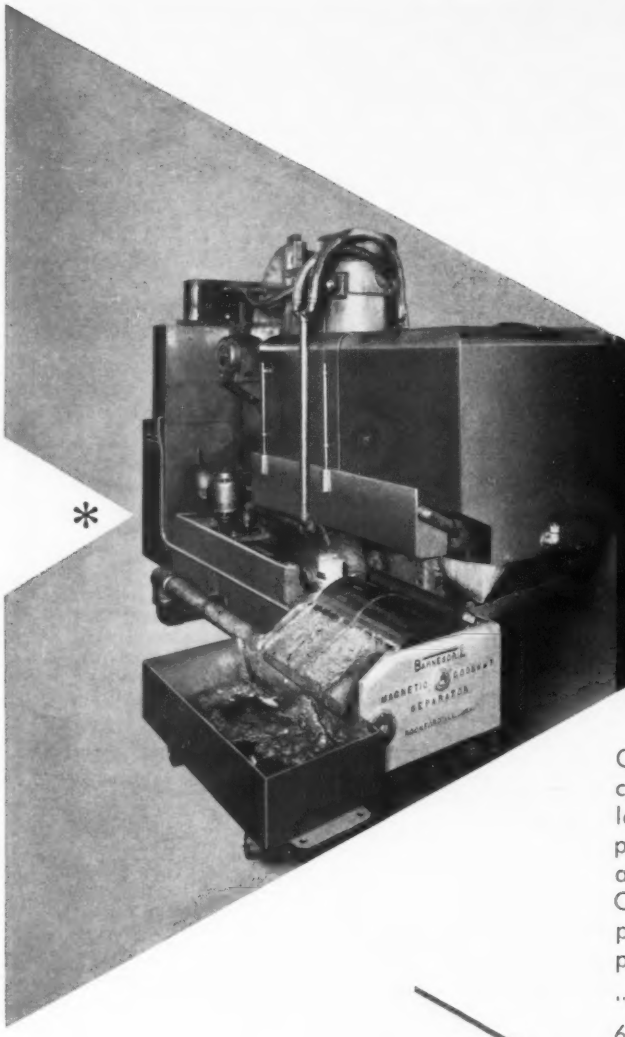
American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



*

CUT maintenance, labor costs

INCREASE PRODUCTION!

Coolant fed into a BarnesdriL magnetic coolant separator continuously circulates around the drum of powerful permanent Alnico magnets. Swarf, chips, and other ferrous particles are removed. Coolant is cleaned by the separator, thus preventing machine downtime and improving finishes.

a user reports:

"Our surface grinder (above) required 6 hours of cleaning and 5 gallons of coolant per week. With the BarnesdriL magnetic separator installed, there has been no downtime in 4 months and coolant used has dropped to 1 gallon per week. *We cut our grinding costs $65.50 per week.* Paid for the installation in less than 2 months."

These savings are typical. Call your BarnesdriL Factory Representative today or write for Catalog **3005.**

*BarnesdriL Magnetic Separator =4 installed on a Blanchard No. 18 Surface Grinder.

50th year

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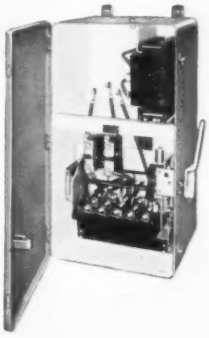
For SATISFYING Power Company and Application Requirements . . .

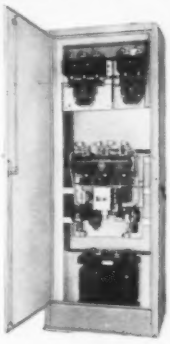
BULLETIN 646
manual autotransformer TYPE

A strictly "modern" starter. Silver alloy, *air break* contacts provide long, trouble free life . . . without the messiness and maintenance of oil-immersed contacts. Operation is simple . . . a bell signals proper interval—which can be adjusted—for switchover from START to RUN. Air break contacts standard in ratings to 75 hp, 220 v; 150 hp, 440-550 v. Also furnished oil-immersed up to 125 hp, 220 v; 250 hp, 440-550 v.



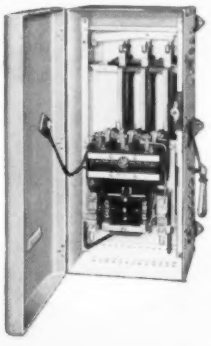
BULLETIN 746
automatic autotransformer TYPE

Employs autotransformer connected in delta to reduce line voltage for starting squirrel cage motors that should not be started on full line voltage. Automatically operated by solenoid contactors with double break, silver alloy contacts. Adjustable timing relay controls accelerating period. Taps are provided on the autotransformer to adjust the motor starting voltage. Ratings up to 300 hp, 220 v; 600 hp, 440-550 v.



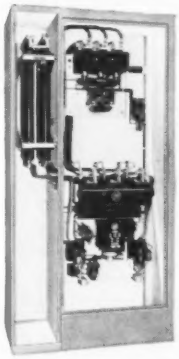
For Velvet S-M-O-O-T-H STARTING . . . nothing equal on the market!

BULLETIN 640
manual stepless resistance TYPE



Graphite compression disc resistors provide smooth, stepless starting of polyphase squirrel cage motors. Operated by hand lever, the smooth starting of the motor is under the control of the operator. Limits starting current and prevents lamp flicker. Accurate overload relays protect motors against burnout. No-voltage protection provided. Ratings to 200 hp, 220-440-550 v.

BULLETIN 740
automatic stepless resistance TYPE



Preset and adjustable graphite disc resistors are automatically inserted in series with squirrel cage motor at starting. Adjustable timing relay operates contactor, which automatically cuts out resistors after predetermined starting period. Resistors can be adjusted to motor and load conditions for velvet smooth acceleration. Accurate thermal relays protect motors. Ratings to 200 hp, 220-440-550 v.

8-57-MR

A-B Quality

Write for Bulletin

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley
Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

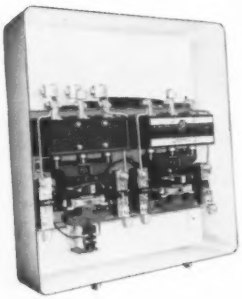
see next page

...and still other

ALLEN-BRADLEY

reduced voltage STARTERS

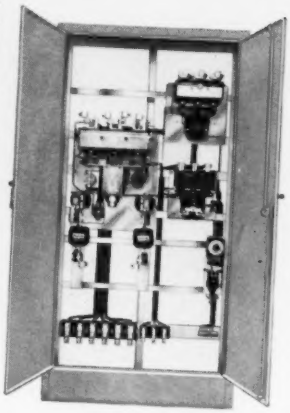
BULLETIN 736...AUTOMATIC part winding TYPE



For use with squirrel cage motors having two separate parallel stator windings. Provides economical reduced voltage starting when starting current does not exceed power company limitations. Two types—Style A is a 2-step starter available in ratings up to 200 hp, 220 v; 400 hp, 440-550 v. Style B is a 3-step starter with resistance in series with the motor on the first step. In ratings up to 200 hp, 220-440-550 v.

BULLETIN 741...AUTOMATIC multipoint resistance TYPE

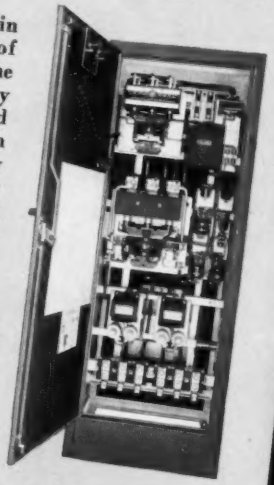
An automatic starter that will satisfy power company requirements for starting of motors on network systems. Resistances are automatically inserted in the line at starting, and are short circuited in steps at definite time intervals. Time intervals can be adjusted from 1 to 5 seconds for ideal starting under various load conditions. Available in 2, 3, and 4-point starters. Made in ratings up to 300 hp, 220 v; 600 hp, 440-550 v.



A-B Quality

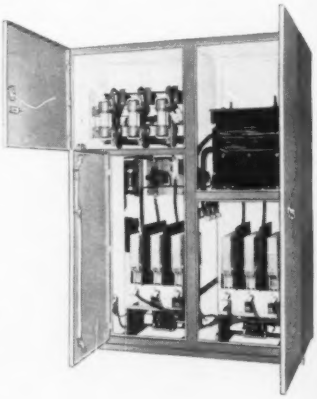
BULLETIN 742...AUTOMATIC stepless, graphite resistance TYPE

This is the ultimate in smooth acceleration of squirrel cage motors. The graphite disc resistors vary in resistance smoothly and steplessly as the pressure on them is automatically changed. Also, the rate at which pressure is applied can be varied over a wide range. Lamp flicker on network systems used for both power and light is completely eliminated. Also ideal where a starting shock to driven machines may cause serious trouble or affect machine life. Ratings to 200 hp, 220-440-550 v.



BULLETIN 1172...AUTOMATIC high voltage, air break reactor TYPE

For starting high voltage squirrel cage motors at reduced voltage. Simple solenoid air break contactor has only *one* moving part, and the double break, silver alloy contacts need no maintenance. These contactors are designed for heavy duty industrial service and can be used for inching or jogging. Reliable overload relays protect the motor at all times. Starters have interrupting capacities of 150,000 kva. 2300 v; 250,000 kva. 4600 v. Made in ratings up to 1500 hp, 2300 v; 2500 hp, 4600 v.



ALLEN-BRADLEY

QUALITY

MOTOR CONTROL

Allen-Bradley Co.
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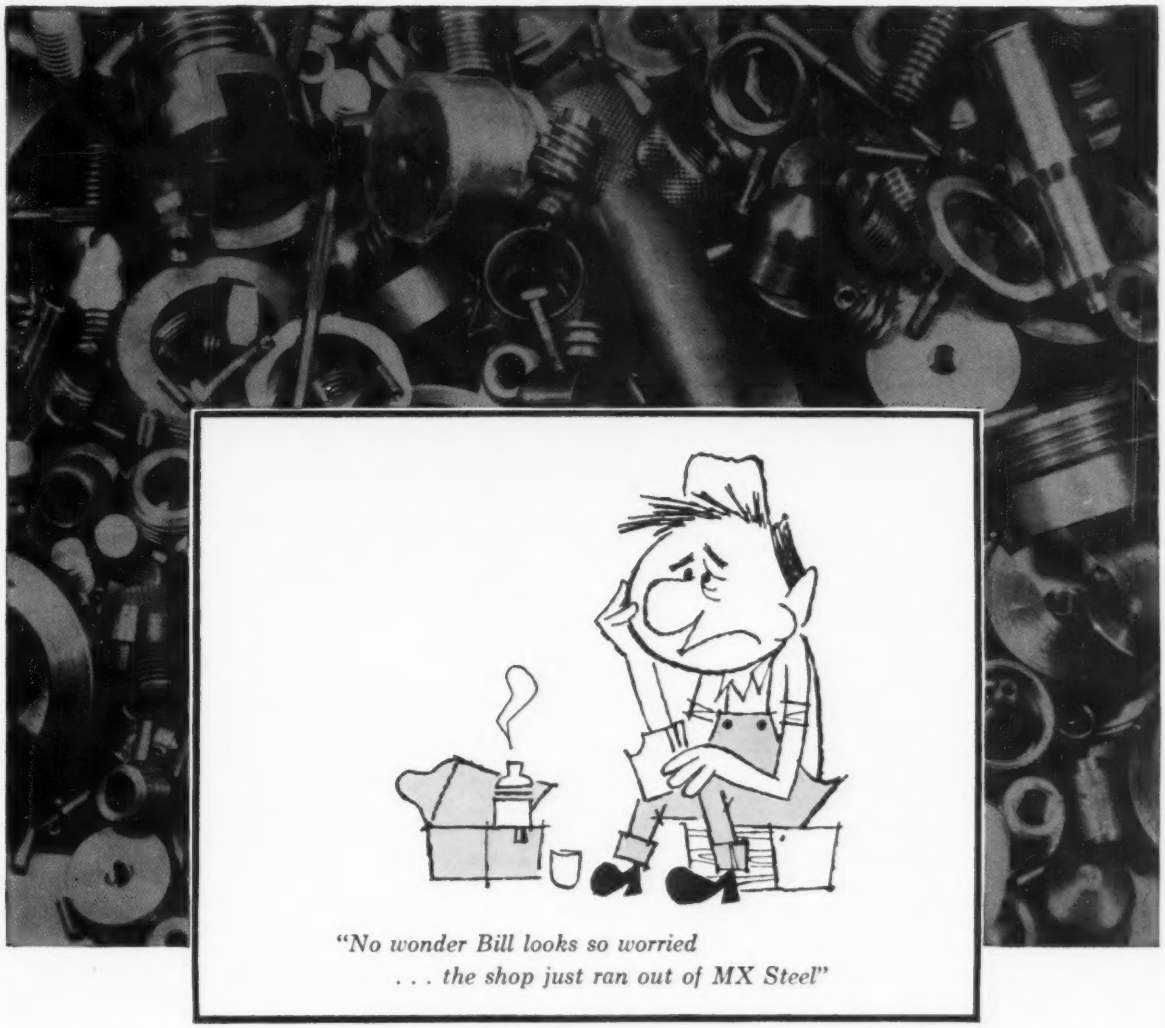
B-37-MR



"No wonder Bill looks so worried . . . the shop just ran out of MX Steel"

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For MX Brand, although it costs no more than ordinary screw stock grades, gives them money-saving advantages that they can't afford to pass up.

By increasing the rate of production, *MX Steel lowers the cost per part.* By prolonging tool life, *MX Steel reduces down time.* By providing closer dimensional accuracy, *MX Steel helps to minimize rejects.*

These highly desirable results have been consistently obtained in the production of literally billions of parts—of many different kinds and under widely different conditions. That's why we feel confident that USS MX Steel will cut the cost of any part you now machine from ordinary screw stock.

Remember that USS MX Free-Machining Steel has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today.

USS MX Free-Machining Steel is available in both Bessemer and Open Hearth grades and in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, under either the trademark "MX" or his own identifying trade name. In hot-rolled form, MX Steel is available from our district sales offices.

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USS

—when you do the job with free-machining

MX

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REDUCE YOUR INVENTORIES CEMENTED CARBIDE PRODUCTS

Whether you need one item — or up to fifty packages — you'll profit in many ways when you do business with your Authorized Distributor of Carboloy cemented carbides.

You can reduce inventories by using his local stockroom as your own. You'll save on handling and ordering costs by buying from a single source. You'll eliminate the cost and delays of "long distance" deliveries.

Whether you need standard tools, blanks, inserts, or toolholders, your Carboloy Distributor can deliver from his shelf to your machine in not much more time than it takes to phone in your order.

Authorized Carboloy Distributors can fill your orders faster, because they carry the largest stocks of carbide products in the industry. They back up their complete stocks and fast deliveries with expert technical assistance. Their men are factory-trained by the nation's largest and most experienced manufacturer of cemented carbides.

The name of your local Authorized Carboloy Distributor is listed above — and his phone number is in the Yellow Pages of your telephone directory. Call him today . . . and get acquainted with the many services only he can offer. *Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Ave., Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more information fill in page number on Inquiry Card, on page 229

Universal collapsing tap parts of **MAX-EL** alloy steel finish machined after full heat treatment

Considerable machining is required in the manufacture of parts for these taps. That's why Crucible MAX-EL® 3½ free machining alloy steel was chosen by the Geometric Tool Company, Division of Greenfield Tap and Die Corporation. For with MAX-EL you can rough machine, *then* heat treat even intricate parts before final machining *with no danger of distortion of the steel.*

But the best way to check the advantages of MAX-EL is to try it in your own shop. Like many other users you'll appreciate its superior machinability, freedom from distortion, deep hardenability characteristics, uniformity and quality. And you'll like the longer tool life you get by using MAX-EL.

For complete data . . . and *quick delivery* of MAX-EL alloy steels, from local warehouse stocks, call *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 229

AVOID the **HIGH COST** and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case

hardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts

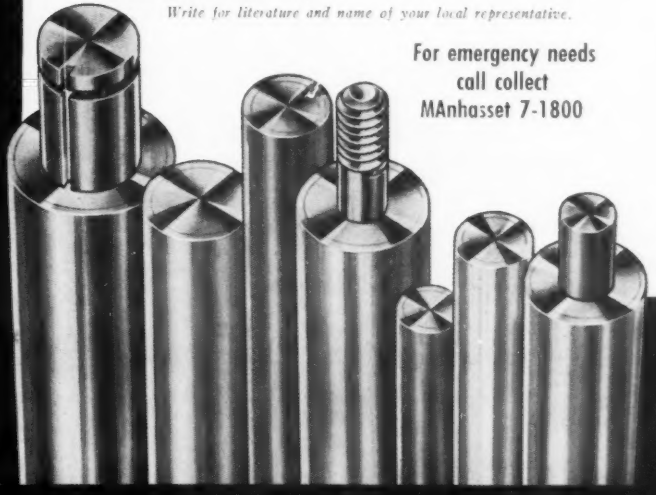
60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.

Write for literature and name of your local representative.



For emergency needs
call collect
MAnhasset 7-1800

ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C-6, Manhasset, New York

HAYNES Alloys solve the *tough* machining problems

Removing metal fast from hard alloys— HAYNES STELLITE alloy tool removes surface imperfections from a hard chromium-nickel ingot. The 98M2 tool is the only one that will handle this machining job successfully.

Biting off a pound of tough alloy per minute

It takes an unusual tool bit to survive the impact of a deep cut when machining rough alloy billets—and still retain a sharp cutting edge while operating at red-heat temperatures.

Yet HAYNES STELLITE alloy tools handle these jobs in stride. At one plant, for example, they have been the standard tool material for the past 10 years machining 6-inch diameter chromium-nickel billets—a particularly rugged operation. A 98M2 tool completely machines 2½-foot long billets, making cuts that range up to ½ in. deep.

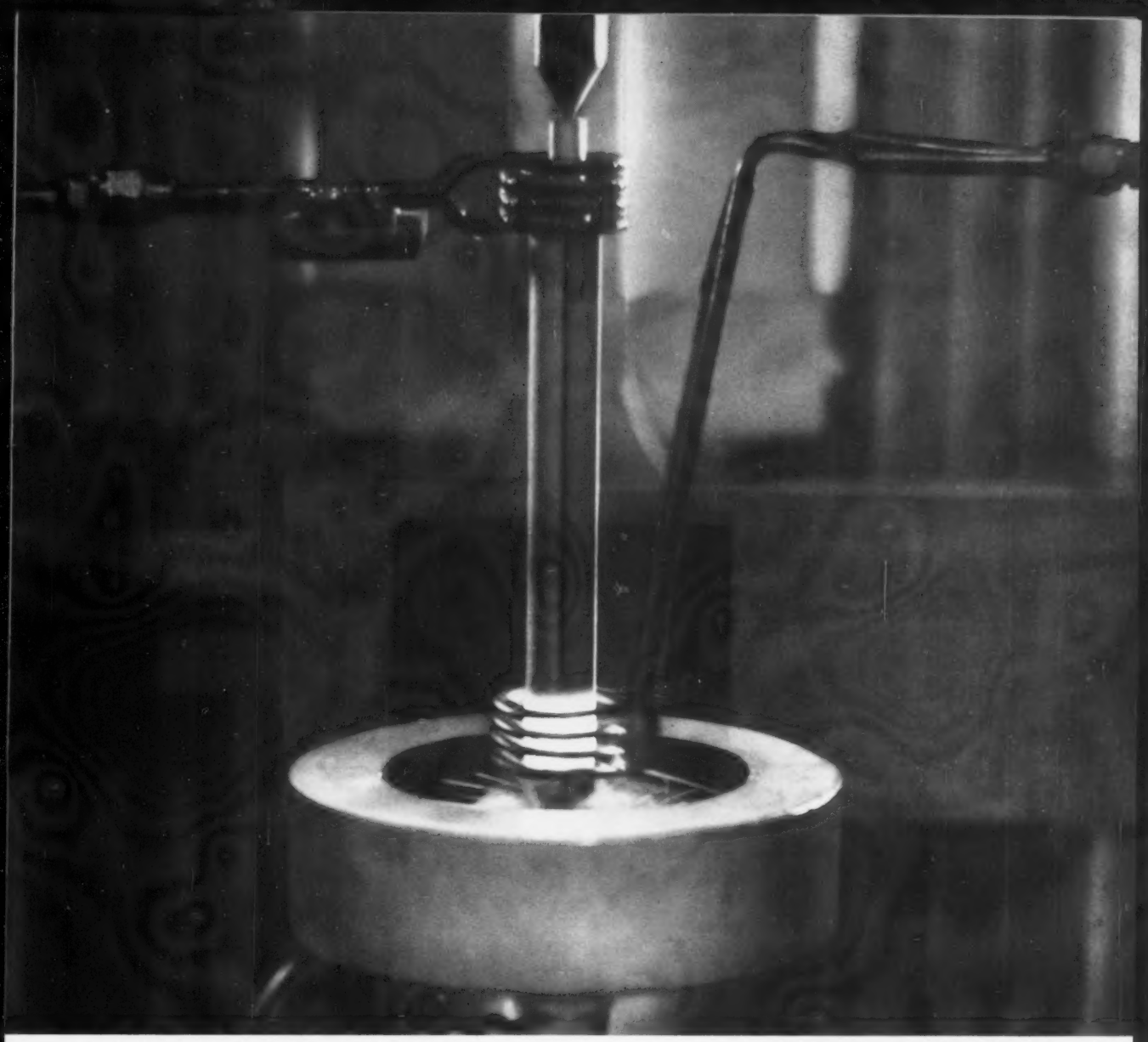
For more information, write for our *Metal-Cutting Tool Manual.* Address Haynes Stellite Company, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.

HAYNES
ALLOYS
HAYNES STELLITE COMPANY
Division of Union Carbide Corporation

UNION CARBIDE

"Haynes," "Haynes Stellite" and "Union Carbide" are trade-marks of Union Carbide Corporation

For more information fill in page number on Inquiry Card, on page 229



Ketos shaft being induction hardened to Rockwell 55-56, while ends remain soft for final machining. Photographed at Control Instrument Co., Inc., Brooklyn, N. Y.

KETOS has wide hardening range with minimum volume change...

Ketos is a low priced alloy tool steel that can be hardened from low temperatures with practically no volume change. It has deep hardening qualities, and a fine grained structure, that make it desirable for many production parts.

That's why nondeforming Ketos is well suited not only for most tool steel applications such as gauges, dies, and taps but also for close-tolerance, wear-resistant parts like the actuator bar shown in the induction heating unit above. The thin contact edges of this particular part withstood a "life test" of over 4-million high speed blows. No other steel tested lasted more than 1-million cycles before it chipped and failed.

If Ketos sounds like the steel you should be using, call your nearby Crucible warehouse. Stocks of Ketos and dozens of other special tool steels are large, delivery fast. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

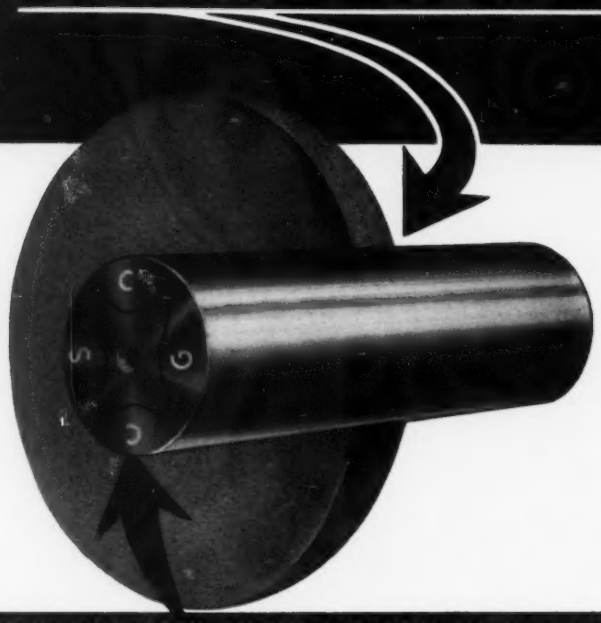
Canadian Distributor — Railway & Power Engineering Corp., Ltd.

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight, smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 INCORPORATED 1892

For more information fill in page number on Inquiry Card, on page 229

Tool Steel Topics

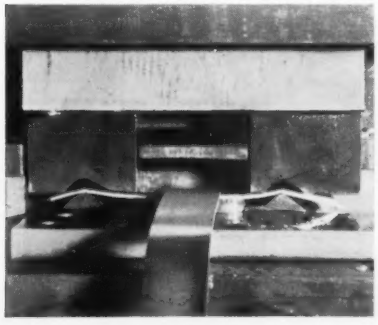
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

Maker of Beer-Can Openers Likes Economy of Lehigh H

Cadet Manufacturing Corp., San Antonio, Texas, needed a strong, long-wearing die for the economical manufacture of beer-can openers. They put the problem up to their local tool-steel distributor, Earle M. Jorgensen Co., who recommended Bethlehem Lehigh H. "Our experience with this air-hardening grade has shown us how it stands up," the Jorgensen people said. "It's resistant to wear and, besides, has low distortion in heat-treatment."



The die was produced by Precision Manufacturing Co., San Antonio, and heat-treated by Cook Heat Treating, Houston. It was placed in service in a 56-ton press in Cadet's shop, where it was fed C 1035 cold-rolled strip, 0.065 in. thick. Performance was excellent, the die performing economically at the high speed at which the press operated. About 800,000 pieces were produced between grinds.

Lehigh H, our high-carbon, high-chromium grade of air-hardening tool steel, is ideal for tough assignments because of its outstanding wear-resistance and toughness. It is well known for its minimum distortion in heat-treatment, and high compressive strength.

TYPICAL ANALYSIS

Carbon 1.55	Molybdenum 0.80
Chromium 11.50	Vanadium 0.40

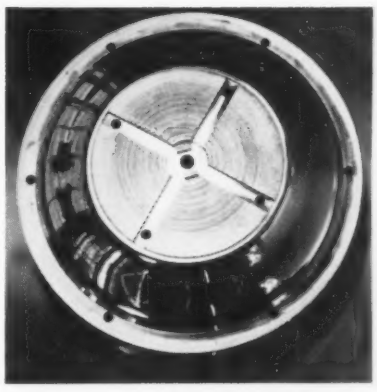
Look into the advantages of Lehigh H by giving it a try. Chances are good that your local Bethlehem tool steel distributor has Lehigh H in stock. Give him a call.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Follow Up With Temper When Drilling Hardened Tools

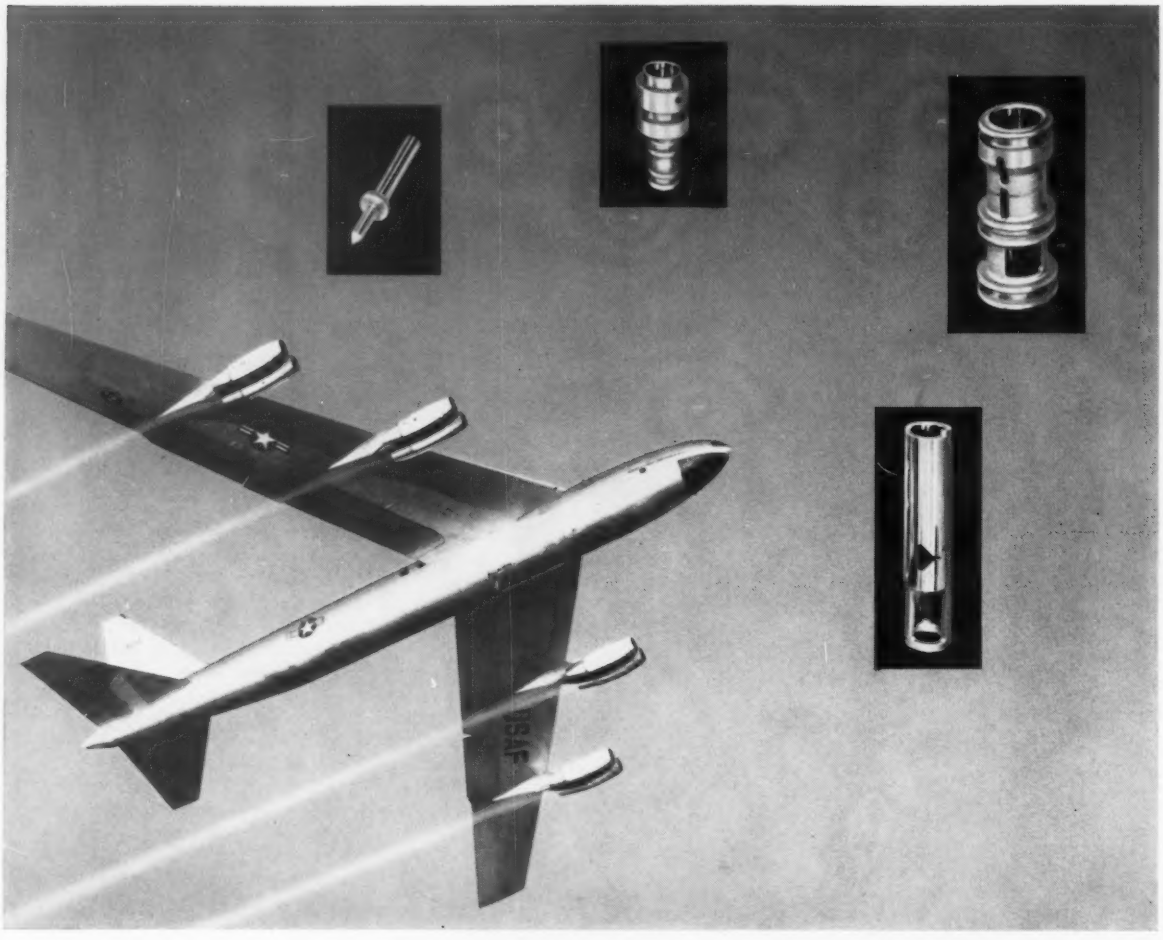
When necessary to drill holes in hardened tools or dies to incorporate dimensional changes, such drilling is usually done with a triangular drill made of a cast stellite or a sintered carbide. This type of drill operates by generating frictional heat sufficient to locally anneal the steel, so that the cutting edges can scrape the metal away in the path of the drill. All tool steel grades, regardless of how high the hardness developed by heat-treatment, can be drilled in this manner.

It is obvious that such a procedure will produce stresses in tools or dies which, because of heat-treatment, already contain residual stresses. It is important, therefore, that the drilling operation on hardened tools always be followed by a tempering operation. Tempering should be carried out at a temperature equal to, or slightly below, the final temper used in the original heat-treatment operations.



Lustre-Die Provides High Sheen When Making Plastic Parts

This core for a plastic injection mold, made by Interstate Mold & Hobbing Co., Union, N. J., is for use in manufacturing a decorative bowl for household use. It is made of Lustre-Die, an electric-furnace steel of well-balanced analysis, which we alloy-fortify to increase its depth of hardenability and mechanical properties. Use Lustre-Die when you want unusually high sheen on plastic parts. You'll like it.



The difference in this stainless makes possible finishes of .000003" on these aircraft parts!

These highly critical parts are used in fuel control systems of America's newest and biggest jet bombers such as the B-52 jet bomber shown above.

Finishes of 3 millionths of an inch are obtained in the machining of these and similar aircraft parts by the fabricator. Carpenter Free-Machining Stainless also enables him to hold close tolerances on complex components. In his own words, ". . . we know we can rely on Carpenter Stainless to hold the dimensions to which the parts are designed."

Why settle for less than this kind of performance from the stainless you use? Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for rush delivery of Carpenter Free-Machining Stainless Steels.

Carpenter STEEL

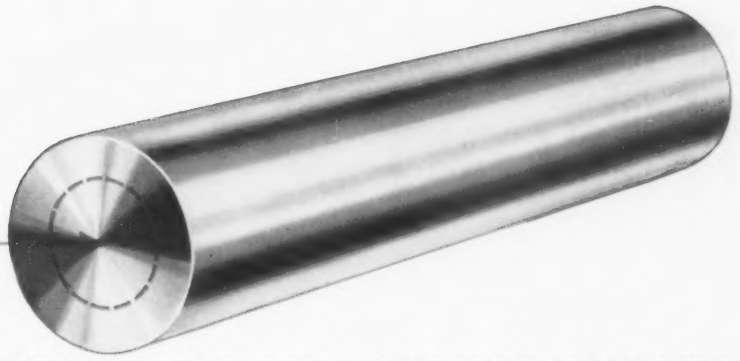
Free-Machining Stainless Steels

The Carpenter Steel Company, 105 W. Bern Street, Reading, Pa.

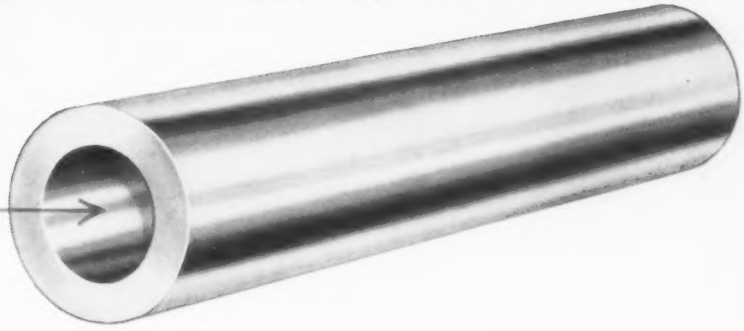
Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Buying bar stock for hollow parts?

Why pay for all this steel



When you can start with this?



Buy TIMKEN® seamless steel tubing

If you're making hollow parts, and bore cut *solid* bar stock, you're paying for steel you don't use. But Timken® seamless steel tubing comes with *the hole already there.* You pay only for steel you use. On top of this saving, you cut machining costs. By eliminating that unnecessary boring operation, you free part of your screw machines for other jobs—add machining capacity without adding machines.

Our engineers will be glad to recommend the most economical tube size for your hollow parts job. By studying your problem and making recommendations, they'll save you money—and the Timken seamless steel tubing they suggest will be guaranteed to clean up to your finished dimensions.

The piercing process by which Timken seamless steel tubing is made is basically a forging operation. You get *fine forged quality*—a uniform spiral grain flow for greater strength, and a refined grain structure. And through our rigid quality control uniform quality is maintained from tube to tube, heat to heat and order to order.

The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

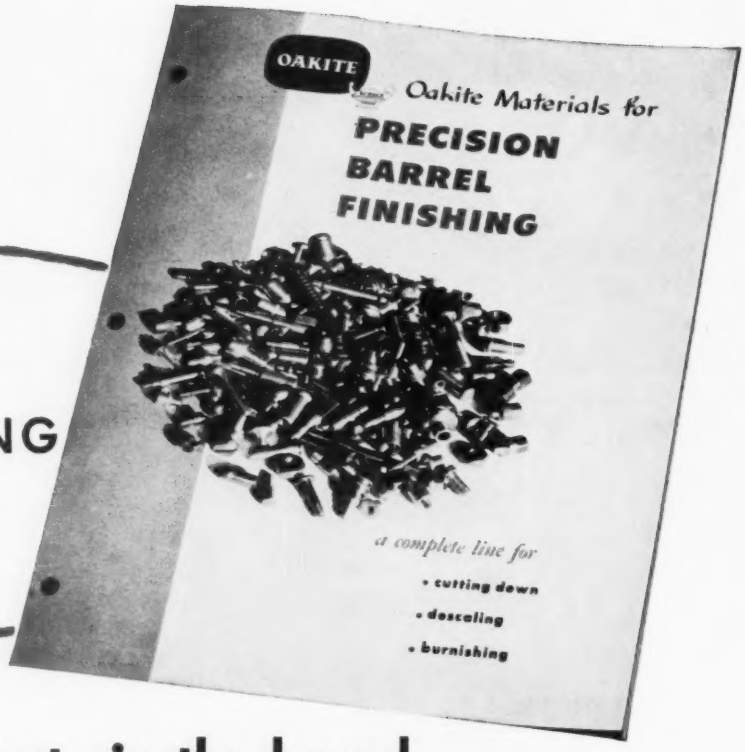
TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 229

HERE'S AN EXCITING GAME



PUT your products in the barrel TAKE your profits out

A great way to save money is to barrel finish metal parts by the hundred instead of manually finishing one part at a time.

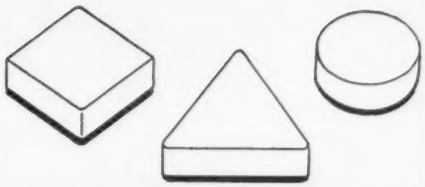
Next time a job of grinding, deburring or buffing proves too costly on a wheel, try it in a barrel. The results are often so surprising that barrel finishing becomes an exciting and profitable game.

One Oakite customer changed to barrel methods to deburr curved stainless steel strips that are 14 inches long. The cost for deburring 20,000 strips was reduced from $3,000 to $125.

FREE For a copy of *"Precision Barrel Finishing"* write to Oakite Products, Inc., 26 Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

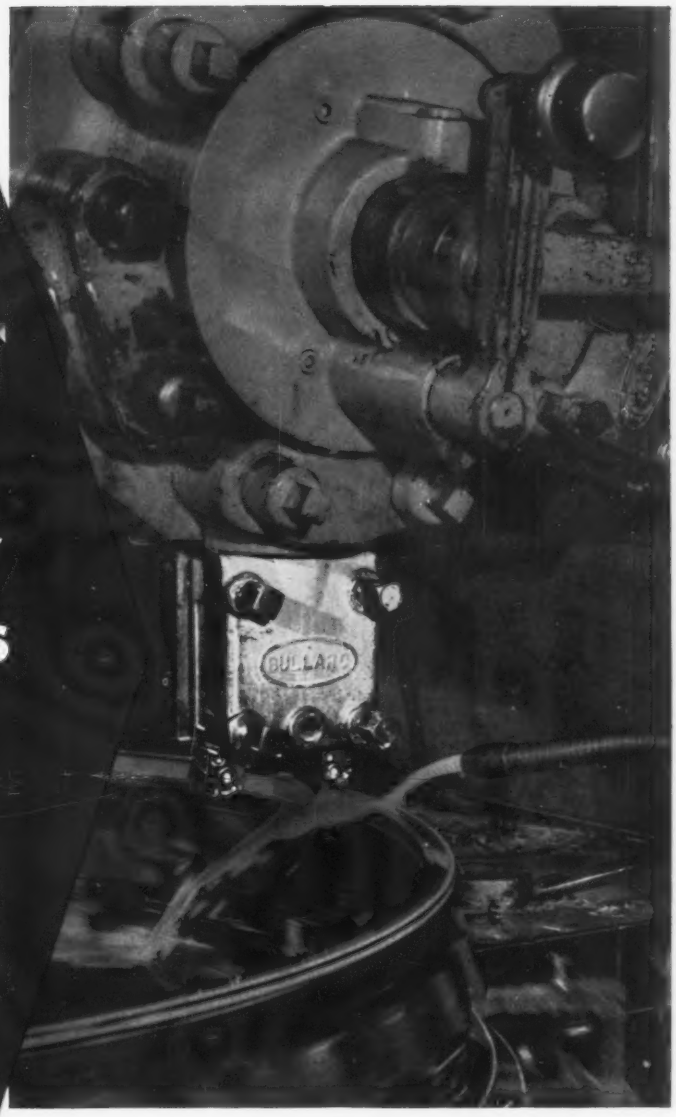
Technical Service Representatives in Principal Cities of U. S. and Canada
Export Division Cable Address: Oakite



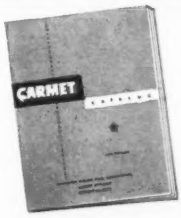
CARMET®

CA-610 THROW-AWAY TOOL BLANKS improved this cutting operation

150%



Write for the NEW CARMET CATALOG



. . . Completely revised, the 16th Edition of the Carmet Catalog contains the latest information on all Carmet grades, and on Carmet blanks, tools, die sections, etc.; also gives details on special preforming and how to order special parts.

Address Dept. M-90

A leading West Coast manufacturer now uses Carmet CA-610 tool blanks for machining components of jet engines and gas turbines. Since switching to this special steel-cutting carbide grade, production has sharply increased from 28 parts per blank *to more than 80.*

Carmet throw-away blanks are designed for any type of tool holder. This same manufacturer reports that the ease and speed with which used blanks may be exchanged for new ones has reduced downtime for tool change-over by 7%.

Advantages such as these are important in *your* industry, too. Call your Carmet dealer TODAY for his advice on any production problems you may have . . . or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Mich.*

For ALL your CARBIDE needs, call

Allegheny Ludlum

Branch Offices or Distributors in Principal Cities WSW 6080-A

AL® CARMET CARBIDES

Will help create new stores of power in Pacific Northwest

This huge forged shaft is one of eight produced by Bethlehem for the generating equipment at The Dalles Dam, on the Columbia River. When finally installed, it will have a part in the vast system of power production now under development in the Pacific Northwest.

Of carbon-vanadium steel, the shaft weighs approximately 190,000 lb; is more than 33 ft long, and has a maximum diameter of 96½ in. Its smallest body diameter is slightly over 38 in. Running the entire length of the shaft is a uniform 15½-in. bore.

Forgings of this size are spectacular, and months of painstaking work go into their planning and manufacture. It's a type of assignment that Bethlehem has been handling for many years. But the big "show pieces" are only a fraction of Bethlehem's output. We are equipped to make and machine any kind of forging ever needed—from giant cylinders, shafts, and columns to midgets weighing a pound or less.

You are invited to check with us when next in the market for press, hammer, drop, or upsetter forgings. Inquiries are welcome, always. Whether your needs are large or small, our engineers will cooperate fully.

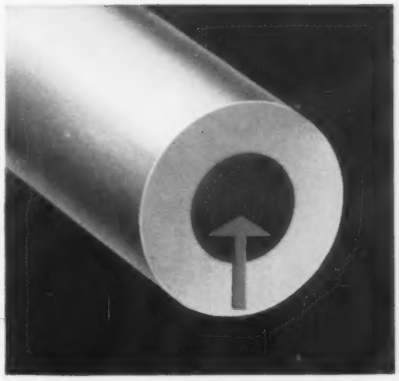
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

a hole here makes waste...



a hole here saves waste

Crucible Hollow Tool Steel cut sections eliminate the waste and cost of drilling out solid rounds to make ring-shaped or tubular steel parts, or tools with a center hole. By using these hollow bar sections, cut to length, you do away with unnecessary cutting, drilling, and boring operations, increase machine capacity, and cut scrap losses.

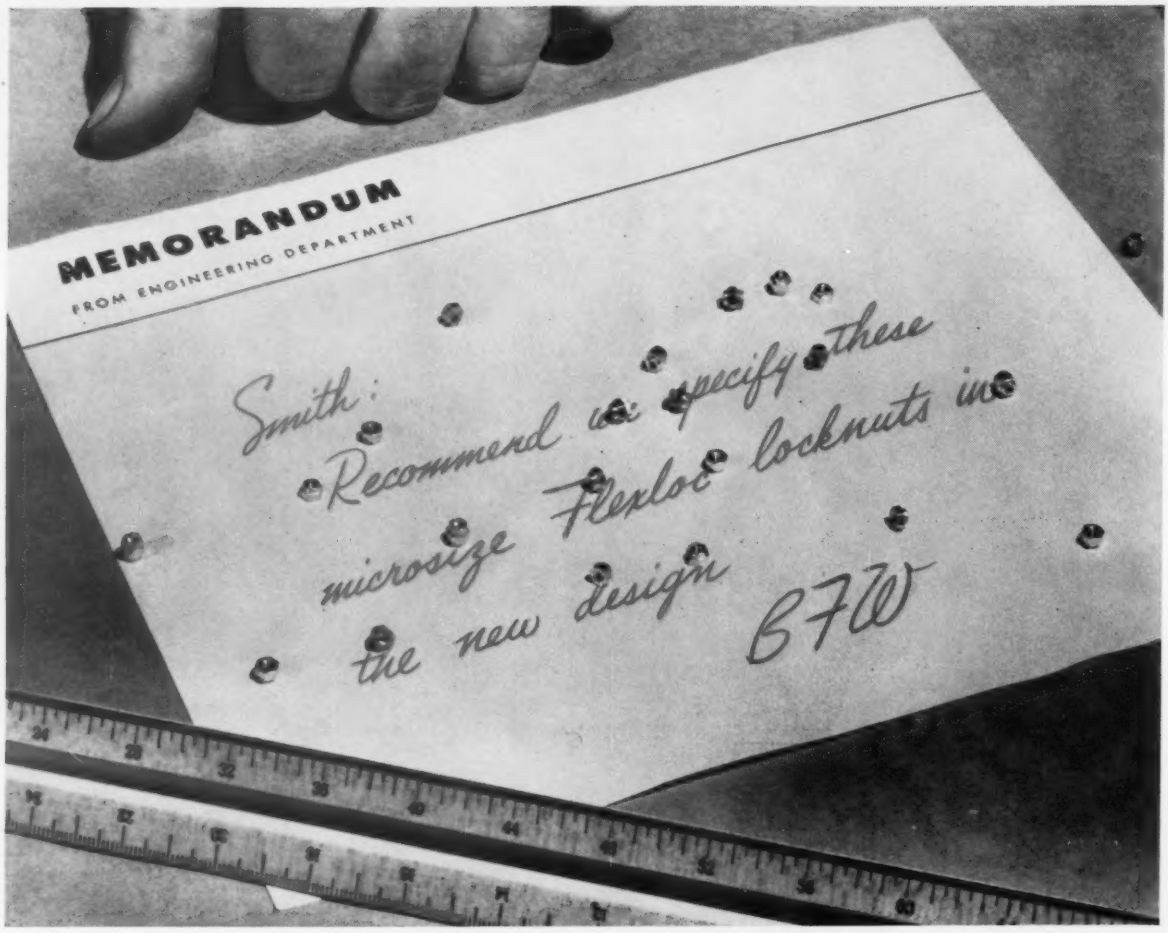
These hollow sections, in just about any O.D. and I.D. combination, or thickness you want, are *immediately* available in five most popular Crucible grades: KETOS oil hardening, SANDERSON water hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air hardening, and NU DIE V hot-work tool steels.

Call your nearby Crucible warehouse for more information, or for speedy delivery. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.



Microsize FLEXLOC locknuts help you design smaller assemblies and fasten them securely

SIZE	Across Flats MAX.	Across Flats MIN.	Hex. Height REF.	Across Corners MIN.	Height REF.
0-80 NF-3B	.111	.107	.046	.121	.075
1-64 NC-3B	.127	.123	.056	.140	.090
1-72 NF-3B	.127	.123	.056	.140	.090
2-56 NC-3B	.158	.153	.067	.176	.105
2-64 NF-3B	.158	.153	.067	.176	.105
3-48 NC-3B	.190	.183	.071	.210	.120
3-56 NF-3B	.190	.183	.071	.210	.120
4-40 NC-3B	.190	.183	.071	.210	.120
4-48 NF-3B	.190	.183	.071	.210	.120

Standard microsize FLEXLOC locknuts are available in brass (plain or cadmium plated) and aluminum (plain or chemically treated) for temperatures up to 250°F; in alloy steel (plain or cadmium plated) and 18-8 stainless steel (silver plated) for temperatures up to 550°F.

Microsize FLEXLOC locknuts save space and reduce weight in electronic equipment, instruments, servomechanisms, and other small assemblies in which weight and bulk are important design considerations. Microsize FLEXLOC locknuts are smaller and lighter than regular FLEXLOCS of the same nominal diameter. They permit smaller mating joints or flanges —with no loss in holding power or convenience of assembly.

Like regular FLEXLOCS, microsize FLEXLOC locknuts are of one-piece, all-metal construction. No inserts to pop out or deteriorate; nothing to put together, come apart or get lost. FLEXLOCS lock and stay locked wherever wrenching stops. You can use them as locknuts or stop nuts. Vibration will not loosen them and they can be used many times over.

For more information on microsize FLEXLOC locknuts (or microsize FLEXLOC self-locking clinch nuts), see your local FLEXLOC distributor or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

STANDARD PRESSED STEEL CO.

FLEXLOC® LOCKNUT DIVISION SPS **JENKINTOWN PENNSYLVANIA**

For more information fill in page number on Inquiry Card, on page 229

This Month's

GEAR PIX

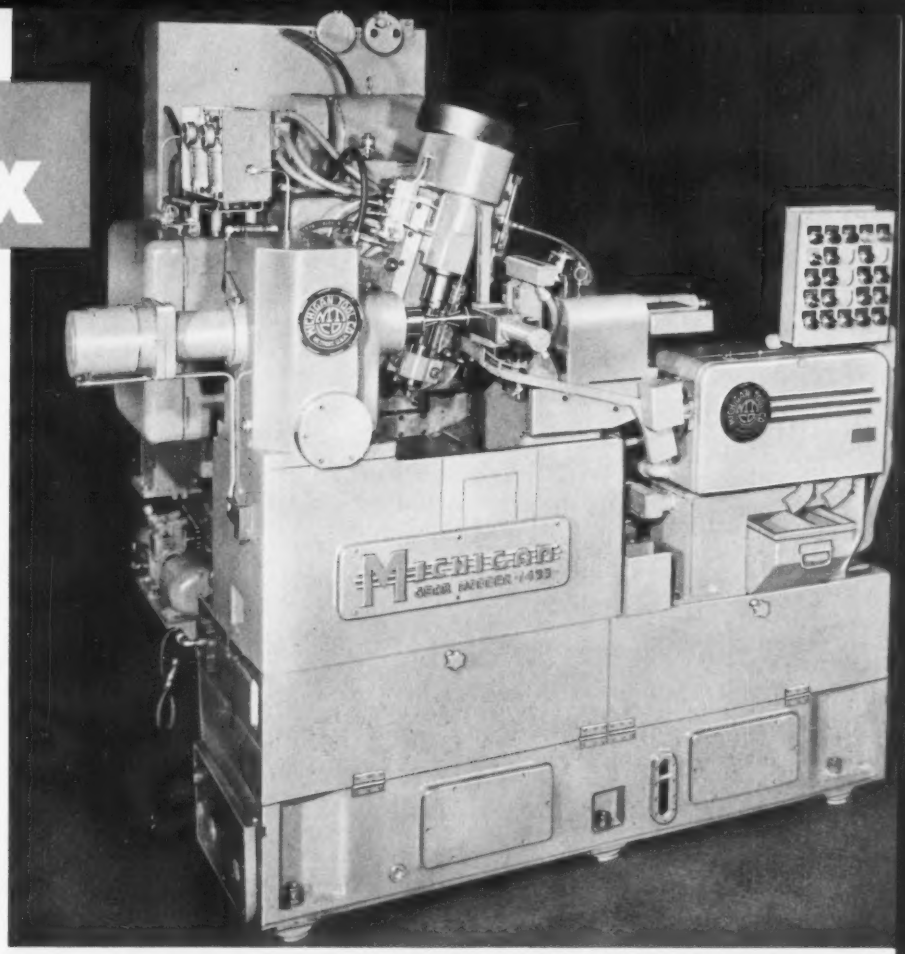
Announcing

A NEW HIGH-SPEED TANDEM

GEAR HOBBER

a new concept . . .

. . . supplies the answers to gear production problems. It's Michigan Tool's newest, the Tandem High-Speed gear hobber, Model 1433. A machine that can be set up in tandem or in-line series to tailor gear output to needs. The 1433 will precision hob spur gears up to 12 pitch or helical gears up to 30° helix. Center distance between hob arbor and work spindle is 3½ inches. Maximum crossfeed stroke is 4 inches.

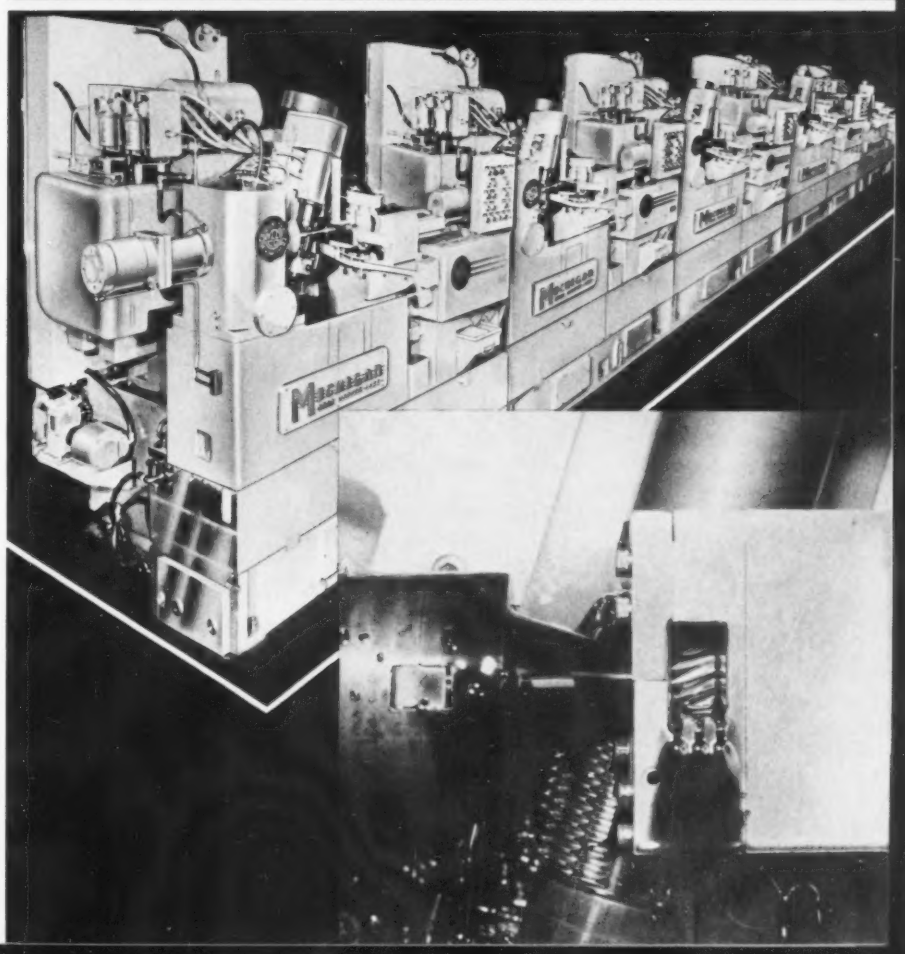


. . . a new dimension

This new hobber lends itself to any degree of automation. Blanks may be supplied from an overhead distribution system. A common sub-base—in any length or configuration—provides parts removal from any number of machines. All machine services including the master panel and electrical connections are self-contained as part of the basic "building-block." Sub-bases are readily joined side by side to any length for any production rate.

. . . a proven principle

The 1433 single-spindle hobber features "plunge" or standard cutter feed, vernier-scale helix angle setting and an automatic expansion arbor for workholding. Set up is fast and simple. Hob speeds range up to 500 rpm—hob feed is infinitely variable. Automatic size control is also provided. Cut gears, automatically unloaded, are air-blast cleaned and automatically checked.



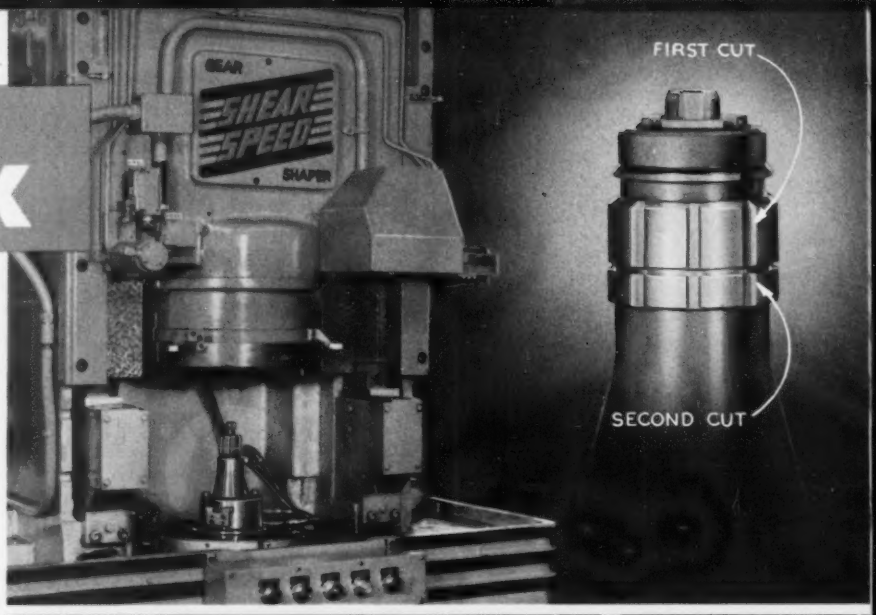
For complete information on Michigan's Tandem gear hobber, write for Bulletin TH-33.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

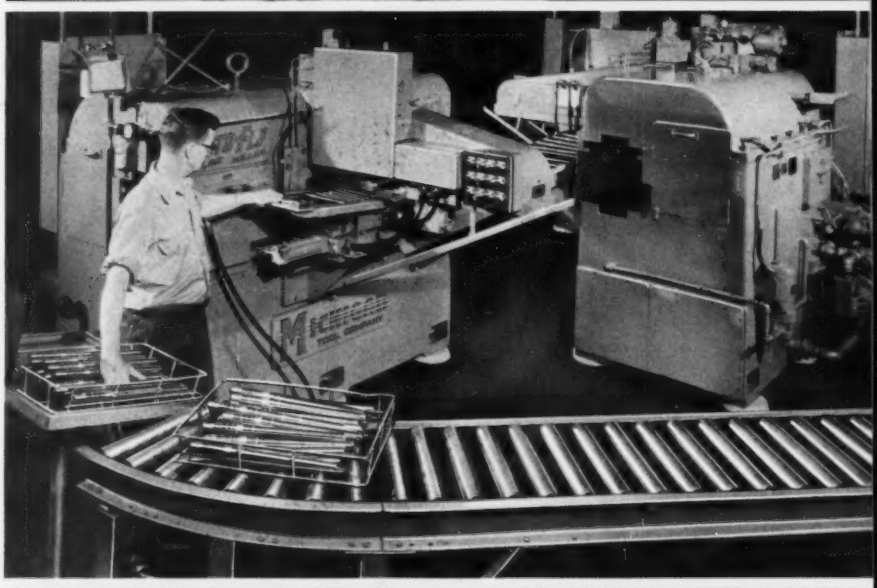
This Month's

GEAR PIX



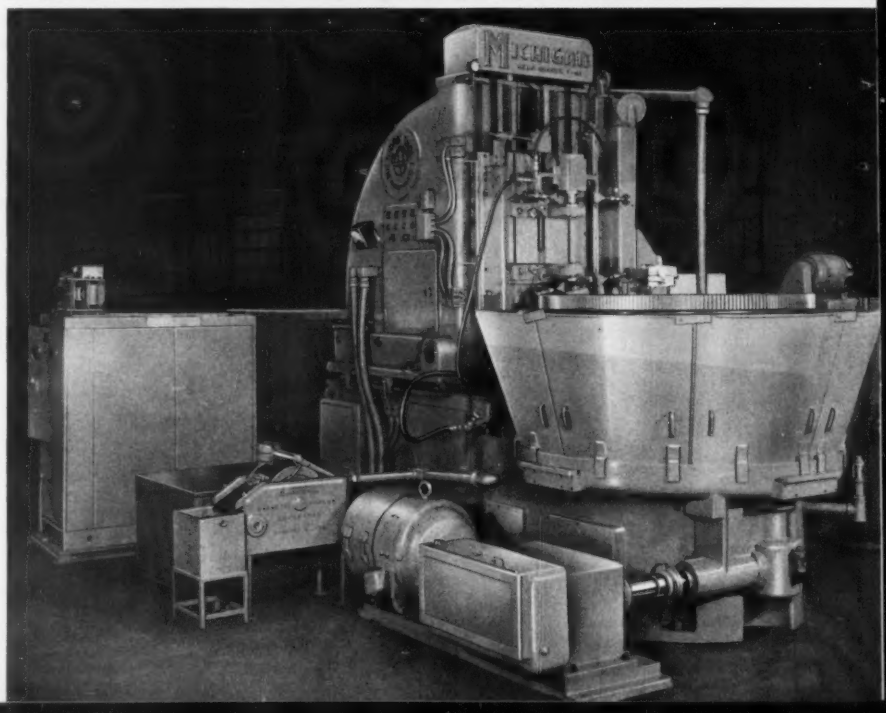
CUTS TWO PD's IN ONE SETUP WITH SAME TOOLS ▶

A new two-stage Shear-Speed gear shaper does the job if you have a part (such as a two-step clutch) requiring two different pitch diameters. It eliminates second setups. The two sets of teeth are cut in sequence (the deeper teeth first) with the machine cutting head locked in two different positions. Differential tool feed takes care of the PD's. Work cycle is automatic. All Shear-Speeds in the 1800 series can be so modified. We'll be glad to fill you in on details.



285 SHAFTS PER HR TRI-SPLINED BY "CHIPLESS MACHINING" ▶

Three different involute splines are cold formed on a transmission shaft in this trio of Michigan Roto-Flo machines. Transfer devices make the setup fully automatic after the first station. The method also offers long tool life and added product strength. More information is available in our Bulletin RF-55. Write for it.



HIGHER PERFORMANCE WITH IMPROVED GEAR SHAVER ▶

An improved Michigan Gear Shaver, Model V-48, cuts spur, spiral or herringbone gears up to 4 ft. P.D. It features full-range drive using only two sets of change gears and an integrated spiral pitch checker. Speeds and feeds are completely variable. Literature available soon.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

Announcing.

... THE WORLD'S FINEST ELECTRIC CLUTCH

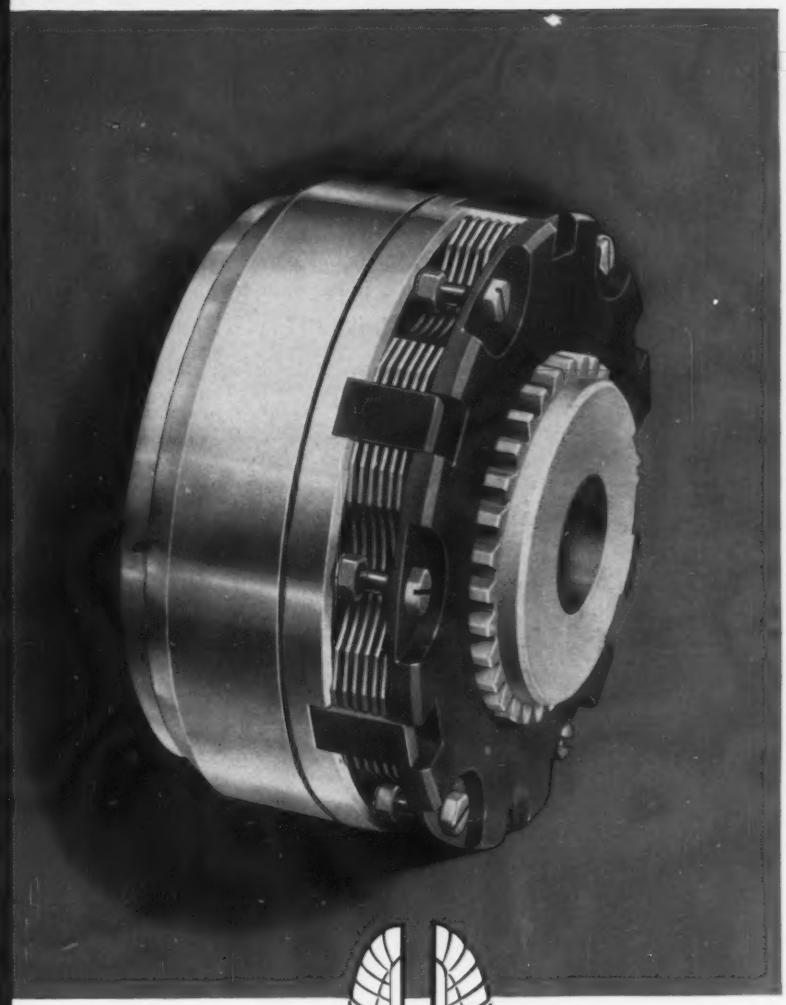
One of the best things that designers and users of electric clutches can know about Fawick Magnetic Clutches and Brakes is that they will outperform and outlast existing electric clutches—at no extra cost!

These precision units will establish new clutch performance standards because they are faster in action, more advanced in design, and more adaptable to a wide range of installations.

They are available in sizes ranging from 2 inches to 13 inches in diameter with torque ratings from 22 in-lbs. to 30,000 in-lbs. For detailed information, write the Home Office, Cleveland, Ohio for Bulletin M-101 or contact your nearest Fawick representative.

Representatives in Principal Cities

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON RD. • CLEVELAND 11, OHIO
In Canada, Fawick Canada, LTD., Toronto



FAWICK Magnetic
INDUSTRIAL CLUTCHES AND BRAKES

For more information fill in page number on Inquiry Card, on page 229

All hydraulic equipment is neatly housed on the car-

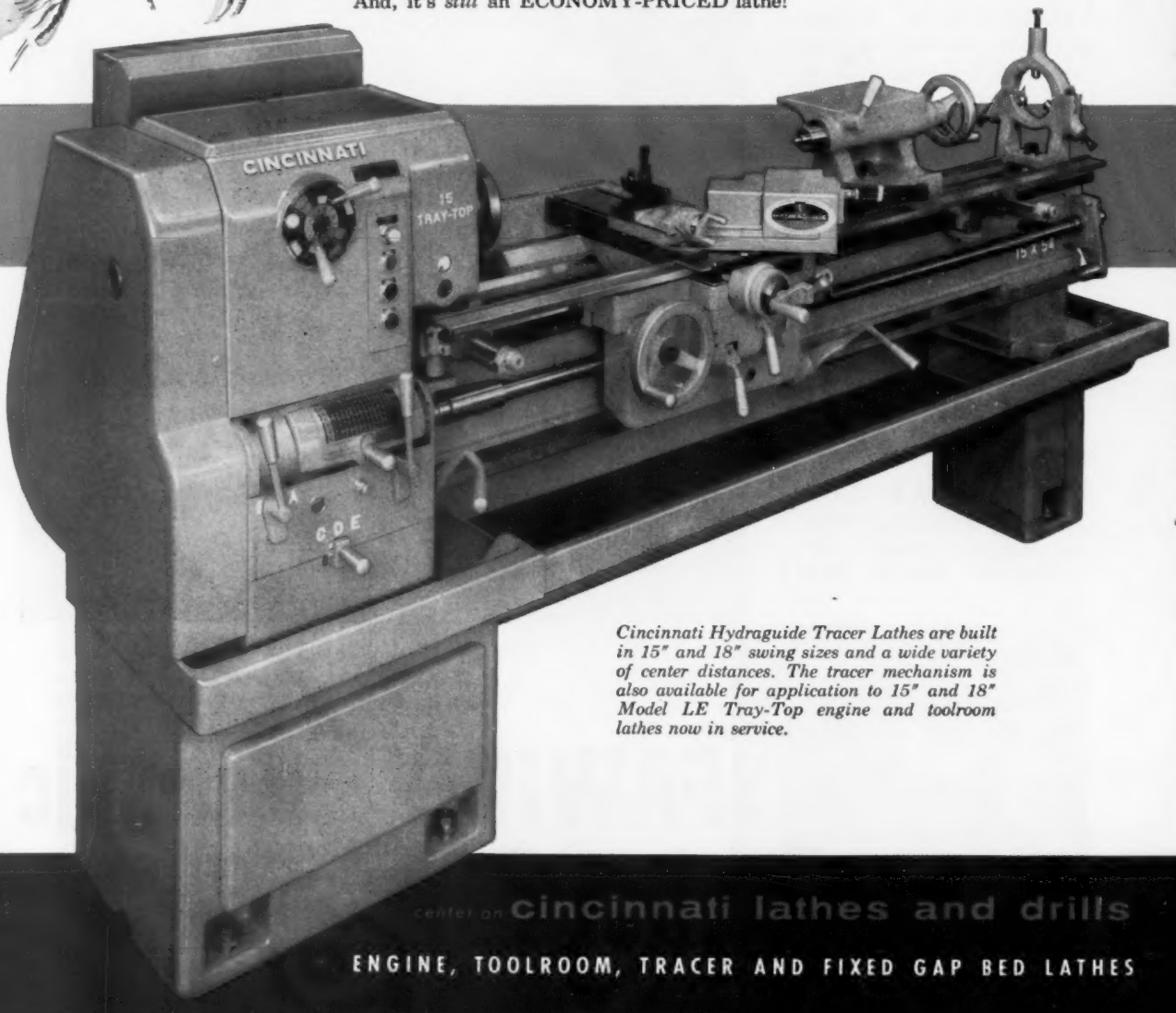
Switch to lowest-cost parts duplication with

CINCINNATI HYDRAGUIDE TRACER LATHES

The most valuable switchbutton in any shop is on these new Cincinnati Hydraguides®. You have only to push this button to provide lowest-cost tracer machining . . . yet, there is no interference with standard lathe operation. Everything is on the carriage, but nothing is in the way. Convenient, too! Everything for the operator is on the front side of the lathe.

ALL the proven Tray-Top features are included, of course . . . PLUS an increase to 5 horsepower for even greater performance.

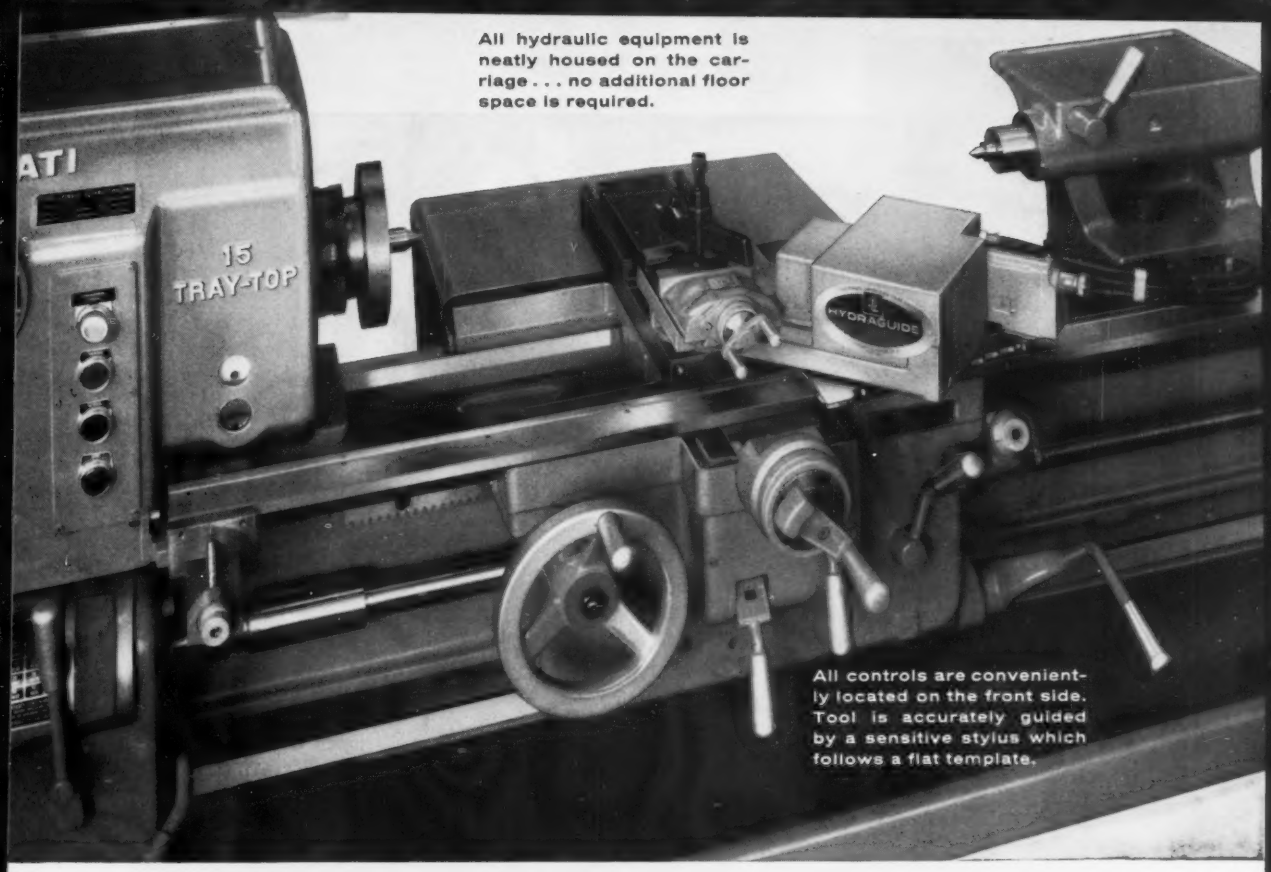
And, it's *still* an ECONOMY-PRICED lathe!



Cincinnati Hydraguide Tracer Lathes are built in 15" and 18" swing sizes and a wide variety of center distances. The tracer mechanism is also available for application to 15" and 18" Model LE Tray-Top engine and toolroom lathes now in service.

center on cincinnati lathes and drills

ENGINE, TOOLROOM, TRACER AND FIXED GAP BED LATHES


All hydraulic equipment is neatly housed on the carriage . . . no additional floor space is required.
15
TRAY-TOP
HYDRAGUIDE
All controls are conveniently located on the front side. Tool is accurately guided by a sensitive stylus which follows a flat template.

take advantage of newest tracer lathe economies NOW!

You get them all in the new CINCINNATI HYDRAGUIDE . . .

Unsurpassed VERSATILITY

Hydraguide performs exacting operations of turning, boring, shoulders, radii and many facing cuts . . . automatically controlled by flat, easily-made templates. Or, can be instantly used for standard lathe operations.

Unequalled COMPACTNESS

The complete Hydraguide is installed on the carriage. This provides more sensitive control because of shortest hydraulic linkage . . . requires no additional floor space.

Unexcelled CONVENIENCE

Hydraguide puts all controls, template, stylus, and tools on the operating side of the lathe. This simplicity of design provides maximum convenience and safety for the operator.

Untold PROFIT POSSIBILITIES

Hydraguide provides all the extra-value features of Tray-Top lathes . . . PLUS automatic duplication, less operator attention, lowest tooling cost, minimum tool setting, closer tolerances, less scrap—*lowered cost per piece.*

Ask your nearby C L & T Dealer for the Hydraguide story. Write today for full data and specifications—Catalog H-150.

It has ALL the Proven Tray-Top Features—

12 spindle speeds, instantly selected with direct-reading, color match dial.

Spindle speed range 37 to 1470 RPM.

All-geared spindle drive transmission.

Totally enclosed quick change gear box. 48 thread-feed changes.

Flame-hardened and ground bedways insure years of accurate service.

Hardened steel gears in all transmissions assure long-life operation.

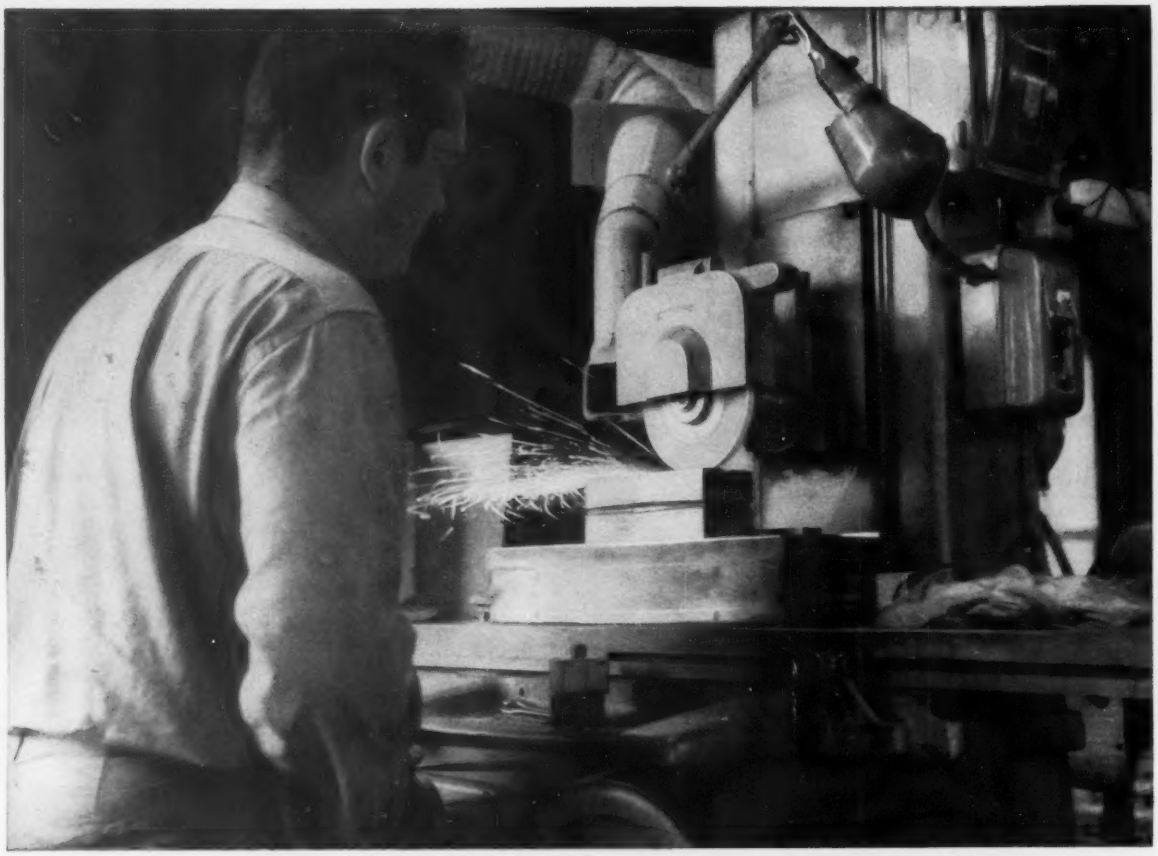
Fully enclosed electrical controls increase operating ease and safety.

Many other features usually found only on larger, more expensive lathes.

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street, Cincinnati 9, Ohio

AND A COMPLETE LINE OF DRILLING MACHINES



"5 years ago Cities Service solved all our lubrication problems and we've never had another!"

A report from Banner Spring & 4 Slide Co., Van Dyke, Michigan

These Were The Problems 5 Years Ago: Banner Spring & 4 Slide Company, maker of small parts for the automobile, electrical and refrigeration industries, was having trouble. Ways, bearings, and drive shafts on 4 Slide machines were getting insufficient film strength from lubricants and constantly burning out. Likewise, compressors were also running hot, and there was complete puzzlement over what type of lubricant to use for Banner's high-speed sewing machines.

Banner decided to call in a Cities Service Lubrication Engineer. A thorough survey followed, with the man from Cities Service carefully examining each machine and its particular operating conditions.

This completed, he made his recommendations — Trojan H-2 Multi Purpose Grease for the 4 Slide machines, Pacemaker No. 1 Oil for the compressors, and Pacemaker 00 Oil for the high-speed sewing machines.

Banner followed these recommendations to the letter. Result: Not one lubrication problem in the past five years — despite the fact that machinery runs 24 hours a day!

If you're faced with a lubrication problem — or if you're just not sure if your present lubricant is best for the job — talk with the man from Cities Service. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

SOME BANNER PRODUCTS: The firm makes all kinds of round wire forms, wire springs, metal clips and flat springs. Use for such products ranges from auto fender support rods to "burlap listings"—the wire frames sewn into burlap which back up automobile upholstery.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 229

Lightning fast speed change

a money making virtue!

This time saving feature of "AMERICAN" Pacemaker Lathes appeals strongly to operators who acclaim it a real money maker for them.

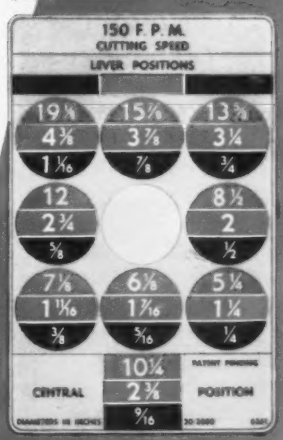
The speed plate is direct reading and shows at a glance the available spindle speeds and how to secure them. Operators can't go wrong. So fast, so easy to read and so simple that they do not hesitate to make speed changes to secure correct cutting speeds.

In addition, cutting speed snap-on plates are available indicating the lever positions for cutting various work diameters at the selected feet per minute cutting speed. These plates may be quickly applied and changed for the desired cutting speed.

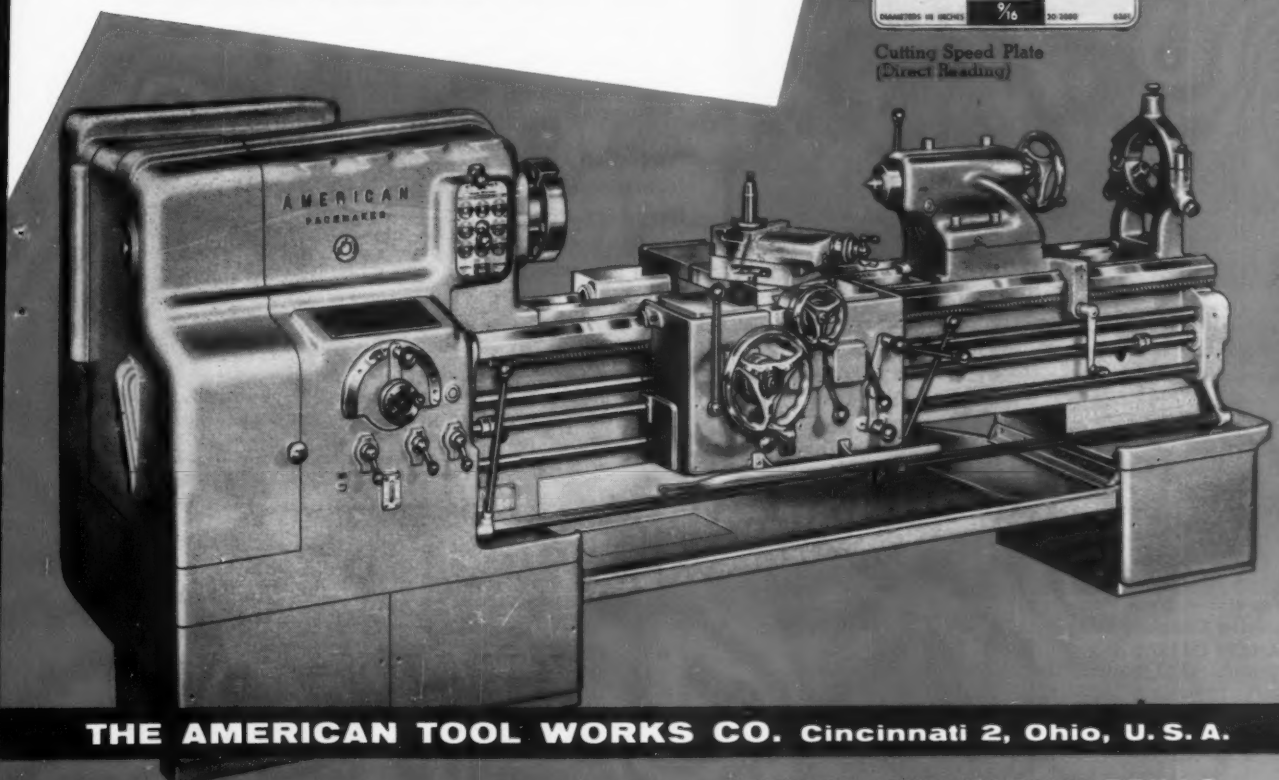
No system for securing cutting speeds could be simpler, faster or less expensive in first cost and maintenance.

- *These and other fine features of the "AMERICAN" DeLuxe Model Pacemaker are illustrated and described by Bulletin No. 116.*

Spindle Speed Plate
(Direct Reading)



Cutting Speed Plate
(Direct Reading)



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Three case histories

How 3 companies improved production by changing to

STANICUT Cutting Oils

Here are reports on three companies that have recorded (1) increases in production (2) better machine performance (3) longer tool life (4) money saved by switching to a STANICUT *Cutting Oil suited to their operations. You can get similar results.*

Standard Oil industrial lubrication specialist, Ray Wells, and Stuart Bergsma, G. A. Brevik manager, inspect carburetor needle valve. Ray recommended plant's switch to STANICUT Oil 137 BCS. He is well qualified to make such recommendations. Ray is a graduate of the Illinois Institute of Technology with a degree in engineering, and he has completed the Standard Oil Sales Engineering School. He has been an industrial lubrication specialist at Standard for six years.

G. A. Brevik Manufacturing Company uses STANICUT Oil 137 BCS

G. A. Brevik Manufacturing Company, Prescott, Michigan, is the largest producer of carburetor needle valves. The company was blending its cutting fluid from four different oils. Still they experienced tool breakage and ring formation on the surface of the stainless steel they were machining. Then one machine was converted to STANICUT Oil 137 BCS to test the oil's suitability for this operation. Soon all machines were converted.

Production increased 25% because of the improved performance of the machine tool. Cutting oil inventories have been reduced from four different oils to one. Tool life has been extended. There is no variation in fluids as there was when four oils were being blended, and there is no messy blending operation.

STANICUT Oil 137 BCS is ideally suited for severe, high speed machining.

A few of the stainless steel parts machined on automatic lathes at G. A. Brevik Manufacturing Company using STANICUT Oil 137 BCS.

STANDARD

Some of the pieces manufactured by Dearborn Centerless Grinding Co. Materials used are stainless steel, Inconel and Nichroloy.

Operator George Laverdiere and Standard Oil lubrication engineer, Leland J. Loomis, examine piece just off Cincinnati centerless grinder. Lee Loomis is another man who knows how to advise on metalworking problems. Lee has had ten years' experience in such work, has an engineering degree from Tri-State College and has graduated from the Standard Oil Company's Sales Engineering School.

Dearborn Centerless Grinding Co. uses STANICUT Oil 126 BCS

Difficult-to-grind stainless steel was the problem at Dearborn Centerless Grinding Company. Wheel loading and wheel break-down were such that soluble type oils weren't satisfactory. For this reason, Dearborn began using STANICUT Oil 126 BCS.

Company management found it secured these six important benefits by changing to STANICUT Oil 126 BCS in grinding operation:

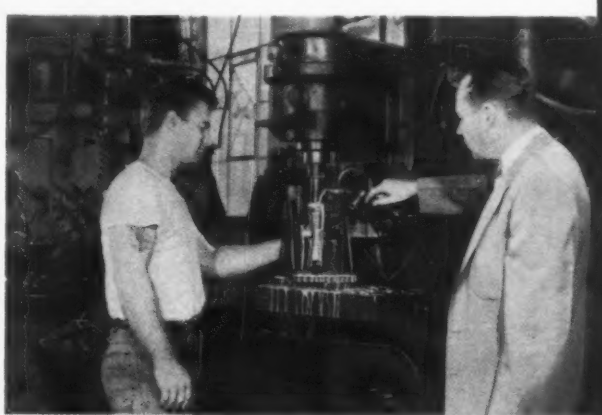
1. Better finishes.
2. More pieces obtained per wheel dress.
3. Superior wheel life obtained on profile jobs.
4. Harder wheels could be used.
5. Finer grit wheels could be used.
6. More stock per pass could be removed.

Woodford Manufacturing Company uses STANICUT Oil 155 CS

This Des Moines manufacturer was drilling and boring a steel wheel fork. Production was at the rate of 45 pieces per hour. Standard Oil lubrication specialist, Jess Nelson, called Woodford plant management's attention to the fact that STANICUT Oil 155 CS was being used successfully elsewhere in the plant. He suggested that much better production and longer tool life would be obtained if STANICUT was used in this operation.

The change, when made, increased production to 78 pieces per hour. Tool life was extended. At the same time, by using STANICUT Oil 155 CS, a 46% reduction in cutting oil costs was achieved.

STANICUT Oil 155 CS is an oil especially formulated for use in machining operations involving tough alloy steels which tend to tear and smear.



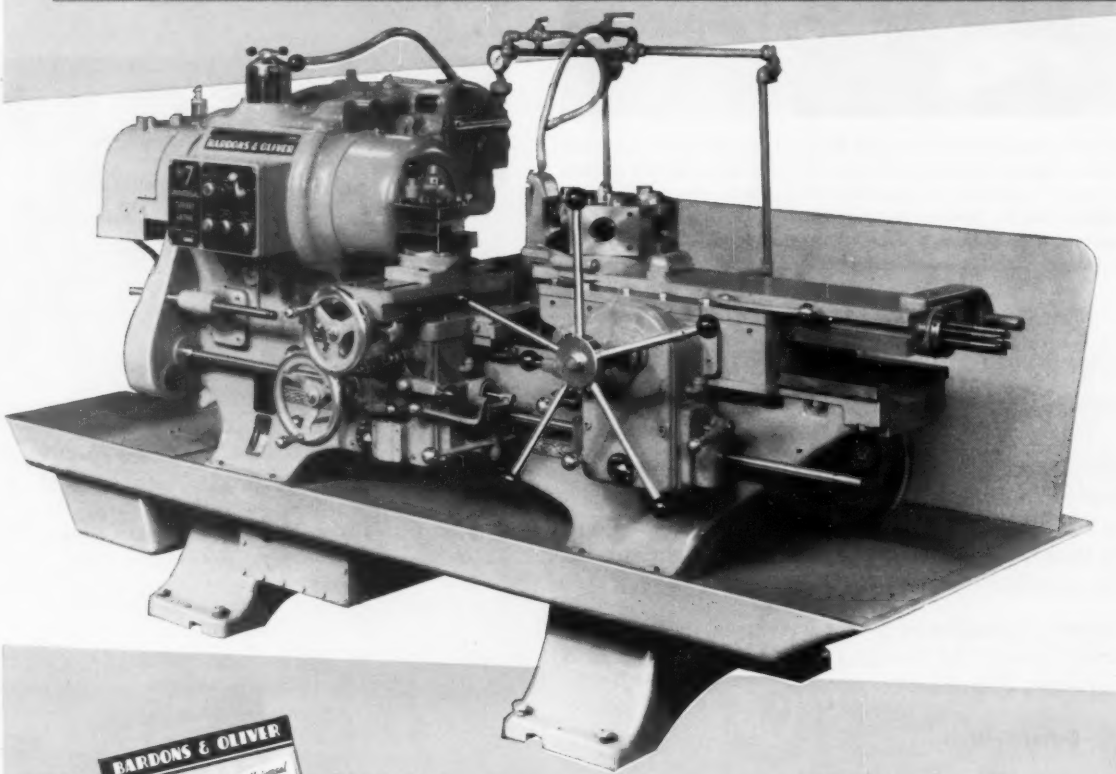
Woodford operator Elmer Light checks piece in Sundstrand Rigidmill while Standard Oil man Jess Nelson adjusts cutting oil flow. Jess, too, knows how to advise manufacturers on metalworking problems. He's had more than four years' experience doing such work. In addition, he has a degree in engineering from the University of Iowa and is a graduate of the Standard Oil Company's Sales Engineering School.

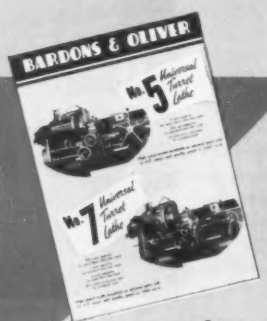
W. B. Noland, Woodford engineer, demonstrates Rollway Dock Plate to Jess Nelson. Parts machined using STANICUT Oil 155 CS are for this unit designed by Noland.

STANDARD OIL COMPANY (Indiana)

Get more data on STANICUT Cutting Oils from your Standard Oil industrial lubrication specialist. One of these men is nearby in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

The BARDONS & OLIVER No. 7 Universal Turret Lathe increased production 35%..and cut Labor cost to one-half..at...





No. 7 Universal Turret Lathe has — 2½ inch capacity for extra heavy duty bar work • 3 inch capacity for standard duty bar work • 4½ inch capacity for light duty bar work • 21½ inch swing over bed for chucking work. Write us on your company letterhead for literature, or send blue prints of your requirements.

Manufacturers of a Complete Line of
Turret Lathes and Cutting-off Lathes

THE SUN NEVER SETS ON B-W BEVERAGE and FOOD PROCESSING MACHINERY

BARRY-WEHMILLER MACHINERY CO.

4660 WEST FLORISSANT AVE. ST. LOUIS 15, MO., U. S. A.

April 5, 1957

Bardons & Oliver, Incorporated
1133 West Ninth Street
Cleveland 13, Ohio

Gentlemen:

The Bardons & Oliver No. 7 Universal Turret Lathe installed in September, 1956 has performed beyond our expectations.

Formerly we used two turret lathes, one for chucking work and one for bar work. However, we now machine all this work on our one new Bardons & Oliver No. 7 Universal Turret Lathe. Furthermore, the total output from the new Bardons & Oliver shows a 35% increase over that formerly obtained from both the turret lathes it replaced.

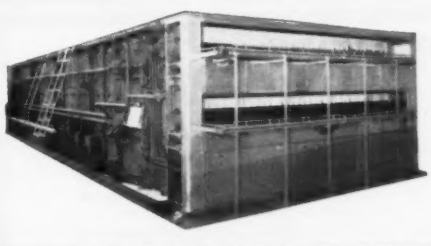
Since we run a large variety of relatively small production lots, we particularly appreciate the versatility of the new Bardons & Oliver as well as the ease and rapidity with which new set-ups can be made.

Sincerely yours,

BARRY-WEHMILLER MACHINERY COMPANY

Tim Boswell

Tim Boswell
Plant Superintendent



"VORTEX" BEER PASTEURIZER

The Barry-Wehmiller Company is one of the world's oldest and largest manufacturers of Bottle Cleaning, Labeling and Processing Machines for the Food and Beverage Industries.

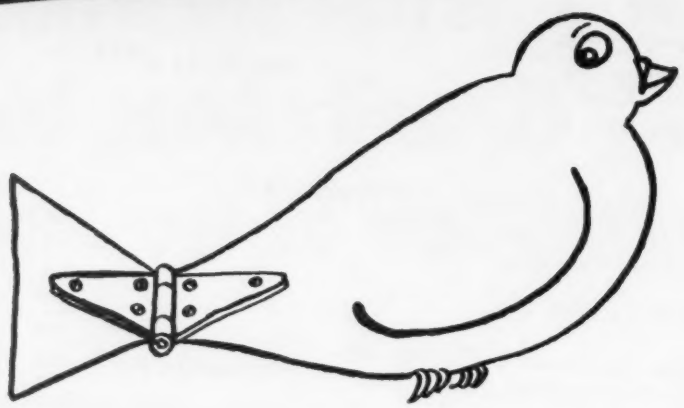
PIONEER MANUFACTURERS OF FOOD AND BEVERAGE MACHINERY Since 1885

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

DROODLES

by ROGER PRICE



Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"DOVETAIL JOINT"

Several years ago, when I first made my mark as a demon bird-watcher, I had a nice little organization going in the upper Bronx, known as "The Feathered Friends". My pal, Speedy Bledsoe, was Pres., I was Treas., and we had 47 dues-paying members. When we split up the city for watching assignments, Speedy and I took 3rd Avenue, near Wally's Place, where he and I held our Executive Sessions. Some of our dopey club members got all churned up when they found out. At the next meeting, they voted a bonus for me and Speedy, consisting of a bucket of hot tar each. Needless to say, they threw in some feathers for good measure.

Speaking of good measure reminds me of the Jones & Lamson Optical Comparator. This is a precisely engineered instrument that is used throughout industry for measuring and inspecting all sorts of parts and objects of various sizes and shapes. It is speedy and accurate (to .0001") and reduces inspection costs to a minimum. The J & L Comparator is extremely versatile, making it equally suitable for both production-line and job-shop work. You'll find it enables you to perform inspections that just aren't possible by any other method. Get the full details . . . point a carrier pigeon Vermont-ward and send this coupon *today!*

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

Involute forms, analyzed for Production Control

J & L's new method not only inspects but also analyzes the form, position, spacing and other aspects of involute gears and splines. This system provides the necessary information for correction or adjustment in the manufacturing process by which these involute forms are generated. *A single master chart covers a wide range of sizes.* WRITE FOR OUR ENGINEERING STUDY, "OPTICAL ANALYSIS OF GEARS AND SPLINES".

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 512 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

"We grind no axe... and really have no need to." After all, Bliss makes so many types and sizes of metalworking presses—actually many more than any other builder—that we favor only the one right press for your job. It may be a big one, a little one, a mechanical, a hydraulic, a standard or a special. But you can be sure it will be the *right* one.

If you have a pressed metal problem, isn't it logical to talk to a source that's certain to give you an impartial answer? To talk to Bliss?

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE

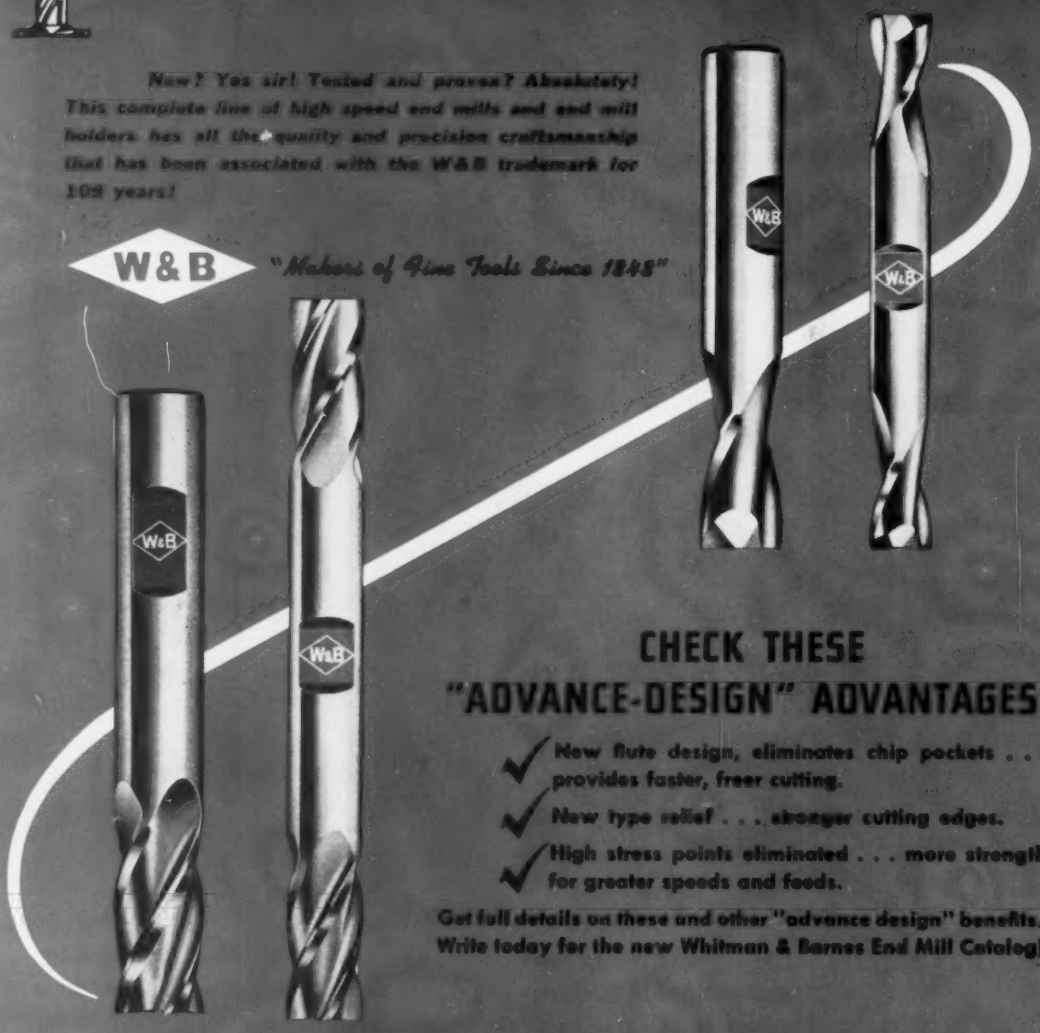
Introducing

WHITMAN & BARNES END MILLS!

a complete high speed series featuring "advance-design" construction!

New? Yes sir! Tested and proven? Absolutely! This complete line of high speed end mills and end mill holders has all the quality and precision craftsmanship that has been associated with the W&B trademark for 109 years!

W&B *"Makers of Fine Tools Since 1845"*



CHECK THESE "ADVANCE-DESIGN" ADVANTAGES!

- ✓ New flute design, eliminates chip pockets . . . provides faster, freer cutting.
- ✓ New type relief . . . stronger cutting edges.
- ✓ High stress points eliminated . . . more strength for greater speeds and feeds.

Get full details on these and other "advance design" benefits. Write today for the new Whitman & Barnes End Mill Catalog!

DRILLS • REAMERS • COUNTERBORES • COUNTERSINKS
CARBIDE TOOLS • SPECIAL TOOLS • TOOL BITS

WHITMAN & BARNES

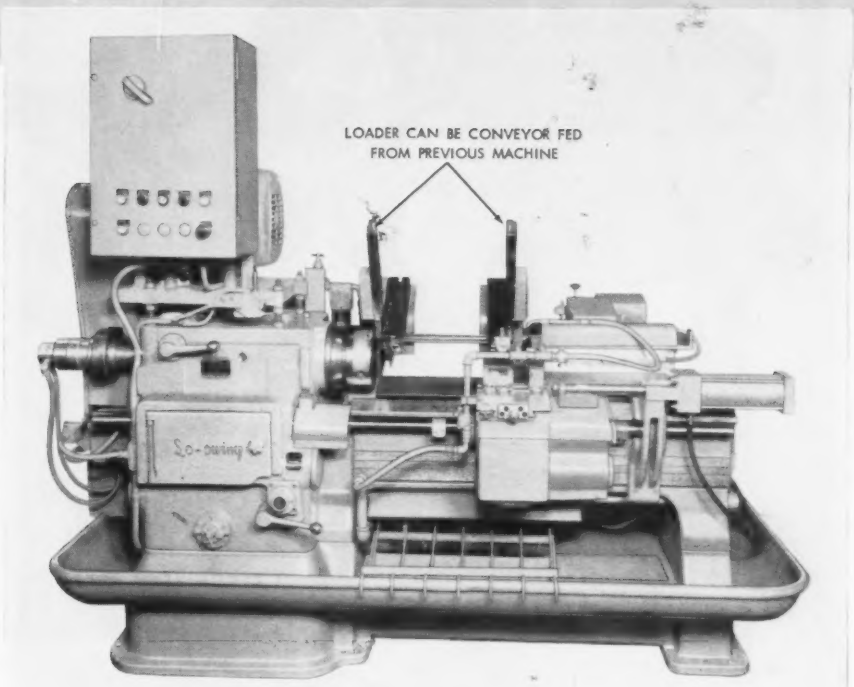
DRILLS and REAMERS

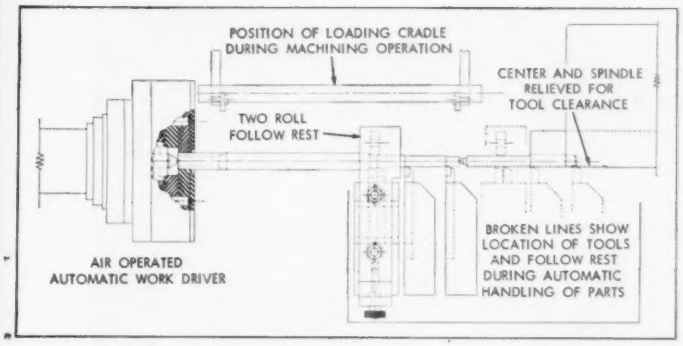
40040 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN
NEW YORK • CHICAGO • LOS ANGELES

For more information fill in page number on Inquiry Card, on page 229

HAVE WE GOT NEWS FOR YOU!

DOES AUTOMATIC HANDLING SPEED PRODUCTION OF MOTOR SHAFTS ON Lo-swing Lathes ?





Typical machining operation wherein loader and lathe operate on a continuous automatic cycle.

SURE DOES! Witness this one. A fast-cadenced, mechanically-operated loader that will handle slim diameter shafts from 5½ to 24 inches in length. All the operator does is keep filling that tall, large-capacity chute with work pieces. He can attend four or five machines without strain. The loader and the Lo-swing Lathe, with its continuously revolving spindle, do *all* the rest.

HOW . . . is a trade secret, but we'll let you in on it if you're really interested. Frankly, it truly amazes us after thirty years of Automation experience.

IF YOU are turning small shafts, like electric motor shafts, pump shafts, textile machine shafts and rolls, twist drill blanks, etc., etc. . . . We sure have news for you!

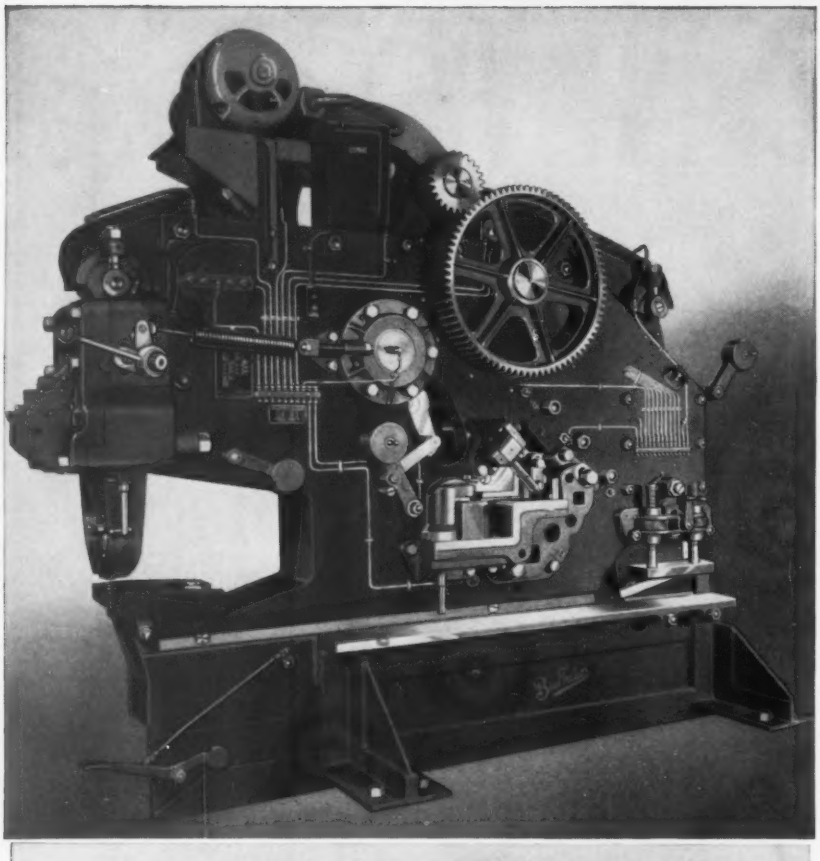
Phone, wire or write for the facts and figures.

SENECA FALLS MACHINE

ENGINEERED FOR PROFIT

SENECA FALLS MACHINE CO.
Seneca Falls, New York

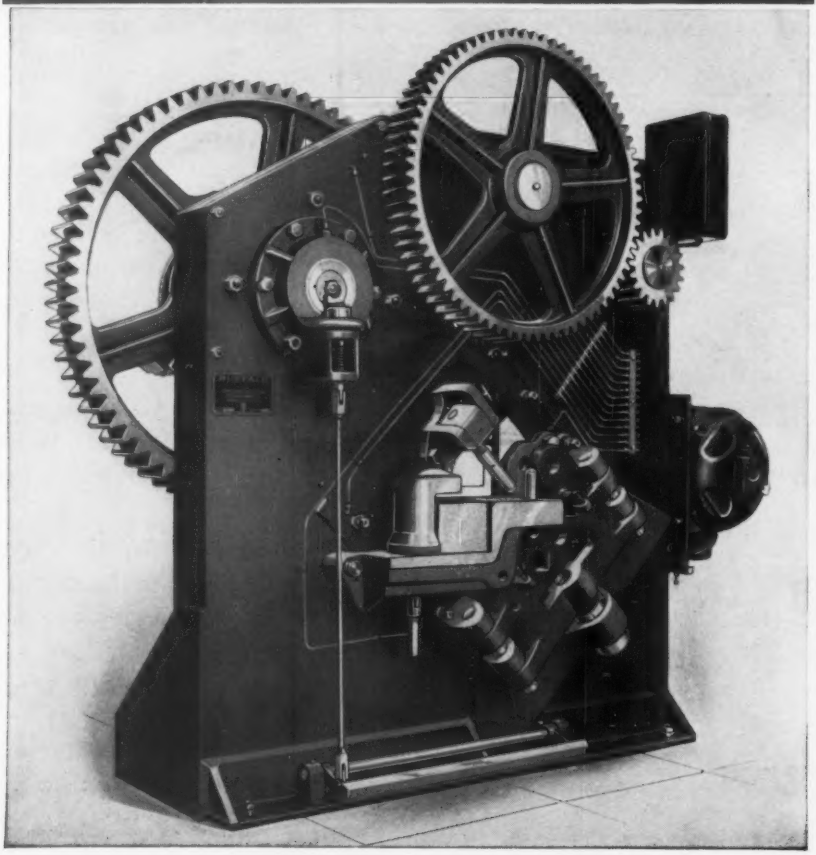
Automatic and Semi-automatic Lathes • Automatic Drilling and Centering Machines
Automatic Work Drivers • Production Tracer Lathes • Automation and Work Handling Devices • Special Production Machinery



DO

"BUFFALO" IRON WORKERS

These powerful, multi-purpose Universal Diagonal machines shown at upper left punch flanges and webs of I-Beams, channels, girders, Bethlehem Beams and H-sections. They notch angles, tees, beams, channels and plates — shear plates, flats and angles — cut rounds, squares, angles at 45° and 90°, and tees. They have the versatility of the popular Universal Iron Workers, plus large capacity — for example, the No. 4½ U.D. Machine shown, has 1 9/16" x 1¼" or 1⅜" x 1⅜" punch capacity and will shear 1¼" plates thru center. It's built up to the job, too, with its welded steel plate box frame, heavy shafts, bearings, bolsters and plungers, plus centralized oiling system. Write for Bulletin 360-G for full capacities and details.



"BUFFALO" DIAGONAL BAR CUTTERS

— like this No. 9 model at left, are easy to set up, fast-cutting and trouble-free. Large knife openings permit wide flexibility of knife combinations for minimum tool changing. 6 sizes, to handle rounds, squares, angles, tees, flats, beams or channels at speeds between 18 and 30 strokes per minute. Largest size cuts 4½" rounds or 4" squares. Also available in diagonal and special models. Write for Bulletin 3295-C, which also describes "Buffalo" Billet Shears.

COLD BENDING AT PROFITABLE SPEED

Heavy industry uses "Buffalo" Bending Rolls like this big No. 2 Horizontal model illustrated on facing page to produce arcs, circles and spirals from heavy sections at profitable speeds. No tooling is required — rolls are quickly changed and adjusted to handle angles, tees, beams, channels, flats, tubes and pipes at the desired radius. All work is bent cold, and commercially accurate curves are easily obtained. Write for Bulletin 352-C.

MORE *BIG* JOBS EASIER WITH "*BUFFALO*" MACHINES!

• CUTTING • SHEARING • BENDING • PUNCHING • SLITTING • NOTCHING

"Buffalo" machines have long been the choice of industries doing heavy structural fabrication — from bridge firms to manufacturers of large machinery. Each of these machines is engineered with the power, rigidity and convenience of operation to turn out the work accurately at profitable speeds. And you have a wide selection — Billet Shears, Bar Cutters, Bending Rolls, Wrapping Rolls, Iron Workers, Mill Type Shears and many others. All are built to the "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life. Write us for recommendations on *your* fabrication problem!

LARGE-DIAMETER ANGLE BENDING

like the above is routine with "Buffalo" Bending Rolls; one tank fabricator forms rings up to 104-ft. in diameter, to fractional-inch tolerances.

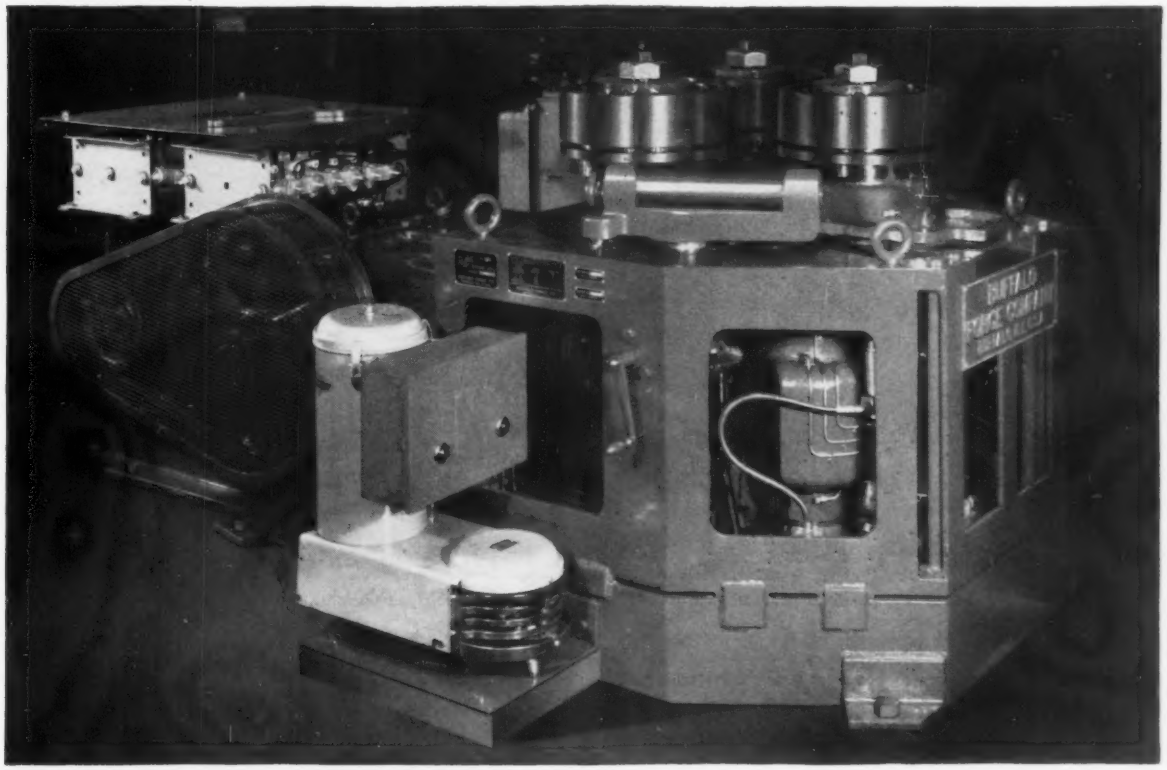
ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

440 BROADWAY **BUFFALO, N. Y.**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING



Another MINSTER First in Press Design Operating in Production Lines Since 1953 Has Proved That You *Can* Get

More Single Stroke Operations

The exclusive "hidden value" in the Minster MS2 press is Minster's patented Intermediate Shaft Combination Air Friction Clutch and Brake Drive arrangement.

This drive arrangement makes it possible to get a higher single stroke efficiency, based upon rated continuous press speed, and the widest speed selection ever available on large double geared straight side presses.

Here's what this exclusive Minster feature can mean to you

- More production on manually fed or automated presses.
- Faster starting and stopping . . . more single stroke operations per minute.
- Less flywheel energy loss . . . lower power consumption.
- Reduced clutch wear . . . less maintenance and adjustment.
- You may select either the faster speeds of a conventional single geared machine or the slower speeds of a double geared press. Two-speed drive (optional) allows selection of a speed to fit different type operations.

How it works:

MS2 presses are double geared and have twin drive gears on the crankshaft. Minster's patented Combination Air Friction Clutch and Brake unit is mounted on a slower turning *intermediate shaft* instead of within the flywheel on the high speed drive shaft.

This means lower contact speed of clutch friction surfaces, resulting in very little heat on linings and less wear.

Flywheel can be run at maximum RPM for maximum energy without limiting speed of operations.

Additional Minster MS2 Press Features

Minster Recirculating Oil Lubrication system provides continuous oil film on all bearing surfaces . . . allows closer bearing and gib clearances for reduced lash and better slide guiding.

All air, lubrication and electrical systems are complete, enclosed within the press frame line, yet easily accessible. Electrical circuits and pneumatic systems for manual or automated production. Controls mounted within cabinet type uprights.

Massive, box type, four-piece tie rod frame for rigidity.

Precise slide to bed parallelism. Slide fully guided within gibs before midstroke is reached.

Outboard drive sheave for easy belt changing.

All wear surfaces bronze-lined, precision fitted and replaceable.

Per Minute

MINSTER®
MS2 Presses

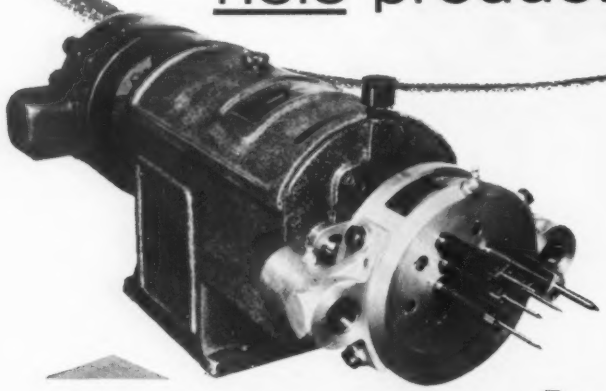
150 TO 500 TON CAPACITIES

in five widths R to L in each capacity—two F to B dimensions in each capacity.

Dimensions meet J.I.C. Standards

THE MINSTER MACHINE COMPANY
MINSTER, OHIO

The Versatile Tap and Drill Team for your hole production



Ettco-Emrick

TAP & DRILL TWINS

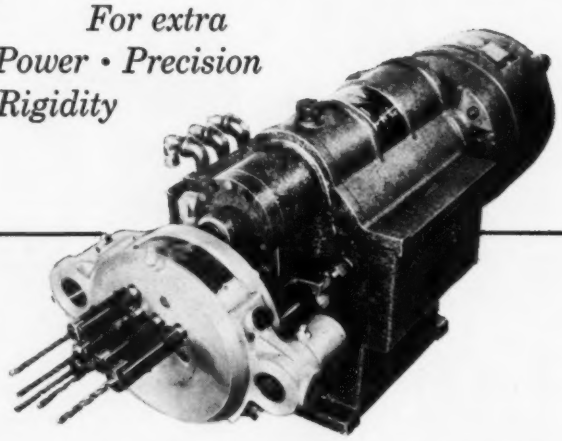
For extra Power • Precision • Rigidity

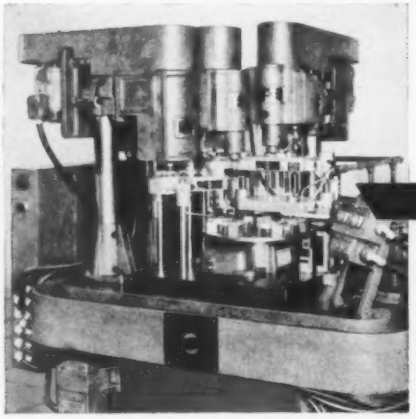
Tapping Unit A.T.U. #3

Completely self-contained all-electric lead screw precision unit. Quickly interchangeable for a fast single or multiple spindle head operation. With forward and reverse electro-magnetic clutches and variable torque control.

Drilling Unit D.U. #2

Completely self-contained precision unit with powerful air feed and hydraulic control. Quickly interchangeable for fast single or multiple spindle head operation.





Used singly or in combination they offer the flexibility and adaptability to meet modern drilling and tapping requirements. When combined with Ettco-Emrick multiple spindle heads they'll set new standards of precision, speed and economy. Write for details!

Special Machines

Building the Twins into high production special machines is simple, because all units are electrically controlled and all components are standardized equipment. We can supply the assembly complete with tooling — or you can do it in your own plant.

THE ONLY FULL LINE MANUFACTURER OF DRILLING AND TAPPING EQUIPMENT COVERING THE ENTIRE SMALL HOLE FIELD!

Authorized Ettco distributors throughout the U.S. and Canada

ETTCO TOOL & MACHINE CO., INC.

592 Johnson Avenue, Brooklyn 37, N. Y.

Chicago • Detroit • Los Angeles • Indianapolis

TAPPING ATTACHMENTS • MULTIPLE HEADS • DRILLING & TAPPING UNITS AND MACHINES • SPECIAL MACHINES • INDEXING FIXTURES • TAP & DRILL CHUCKS

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You get what you want with

DANLY

PRESSES

TOP EXECUTIVES

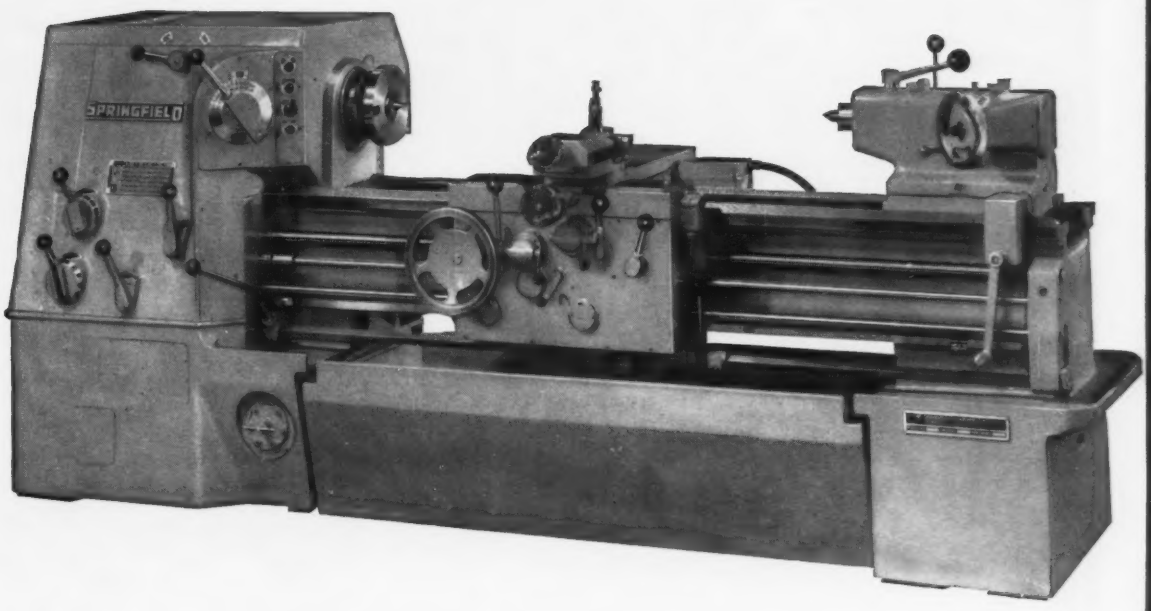
get the speed they need for "on time" delivery

Danly Presses meet the speed and volume requirements of expanding companies. They run at top stroking speeds around the clock . . . minimize breakdown delays . . . need only minimum maintenance. Even double action types maintain a single action pace, thanks to Danly's controlled stroke slowdown. Special drives allow stroking speed to be increased without exceeding safe drawing speed. No need to "gear down" your line when single and double action presses work together. Danly's faster pace saves important time in any shop.

JUST PRINTED. *New book discusses the effect of modern presses on profits and growth of metal-working companies. Request your copy of "Industry's Wealth-Builders" from DANLY MACHINE SPECIALTIES, INC., 2100 So. Laramie Ave., Chicago 50, Ill.*

DANLY

SPRINGFIELD



more useful horsepower

All the horsepower in a Springfield Model "S" Lathe is productive.
A simple, straight-forward gear train, plus double-action lubrication, plus tight dynamic balance tolerances (.0005" displacement) eliminate friction and vibration, the twin horsepower thieves.
In the headstock, only the gears necessary to a given speed are engaged. Other gears run free with a stabilizing flywheel action, no drag on power.
A high pressure filtered oil mist keeps all gears and bearings drenched, and a cascade of oil lubricates the feed box.

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".
Vertical Universal Grinders: swings 18" to 42".

The Springfield Machine Tool Company
Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD

PERFORMANCE REPORT:

Blanchard No. 18 surface grinders have a long history of outstanding performance. They're economical, extremely accurate and highly productive on a wide variety of jobs.

V-490

STANDARD STEEL WORKS DIVISION
BALDWIN-LIMA-HAMILTON CORPORATION
BURNHAM, MIFFLIN COUNTY, PA

November 26, 1956

Machinery Associates, Inc.
325 E. Lancaster Avenue
Wynnewood, Pa.

Attention: Mr. C. Dennen Day, Vice President

OUR PURCHASE ORDER 8781-4576
YOUR ORDER M2-1-809

Gentlemen:

In response to your letter of October 12, 1956 relative to the No. 18 Blanchard High Power Vertical Surface Grinder which you furnished to us on the above order, I wish to advise that this machine has been entirely satisfactory. The machine was purchased primarily for grinding form and hollow bore cutters for our machine shops and the machine was installed in our Small Tool Department. We estimate that the savings which we have already experienced will allow us to amortize the machine in a period of approximately one year. Since the work load on cutters alone kept the machine busy only approximately one-third of the time, we have been able to do additional grinding which was formerly done on other machines and have been able to realize the same economies as we did on the grinding of the cutters.

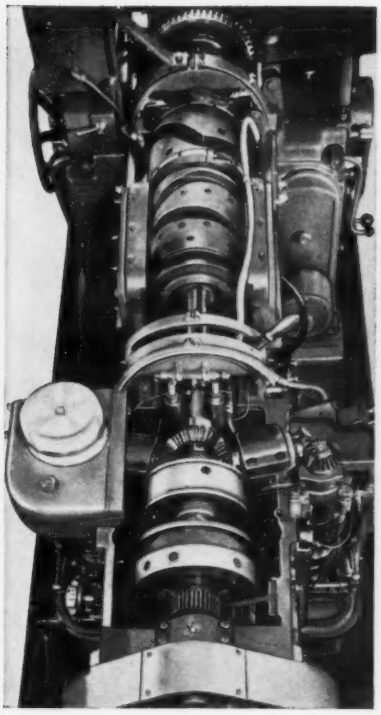
Yours very truly,

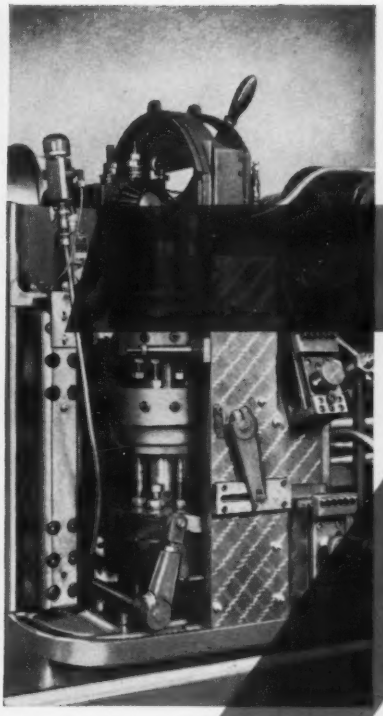
W. E. Shiesler, Jr.
Chief Engineer

PUT IT ON THE BLANCHARD

Send today for your free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding", third edition.

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.



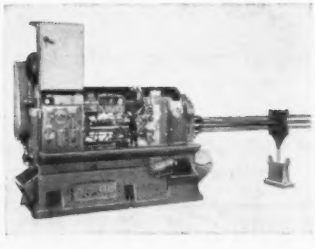


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

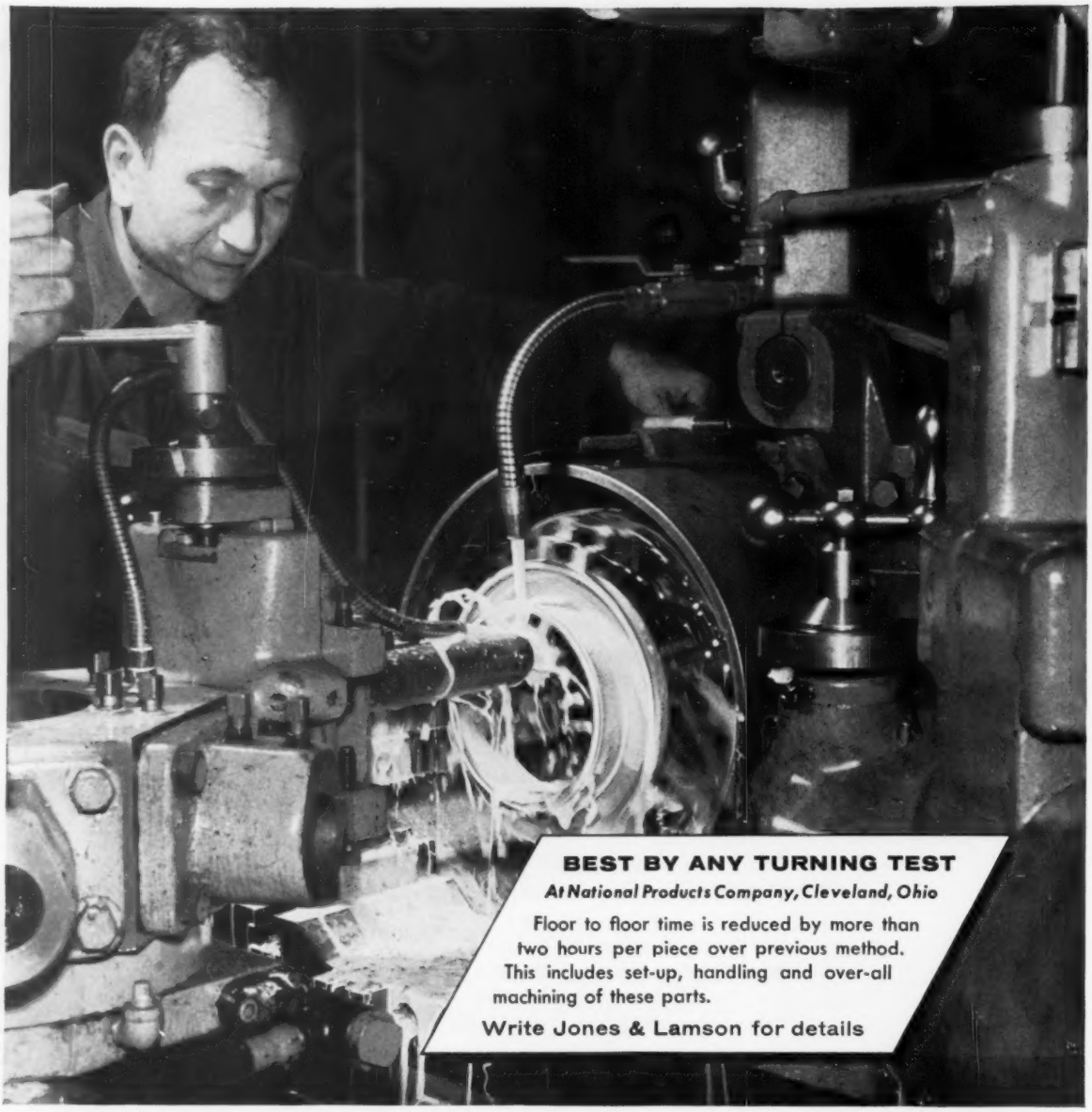
Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1 5/8" Sixes, and the 2 5/8", 3 1/2", 5", and 5 1/4" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.


BEST BY ANY TURNING TEST
At National Products Company, Cleveland, Ohio
Floor to floor time is reduced by more than two hours per piece over previous method. This includes set-up, handling and over-all machining of these parts.
Write Jones & Lamson for details

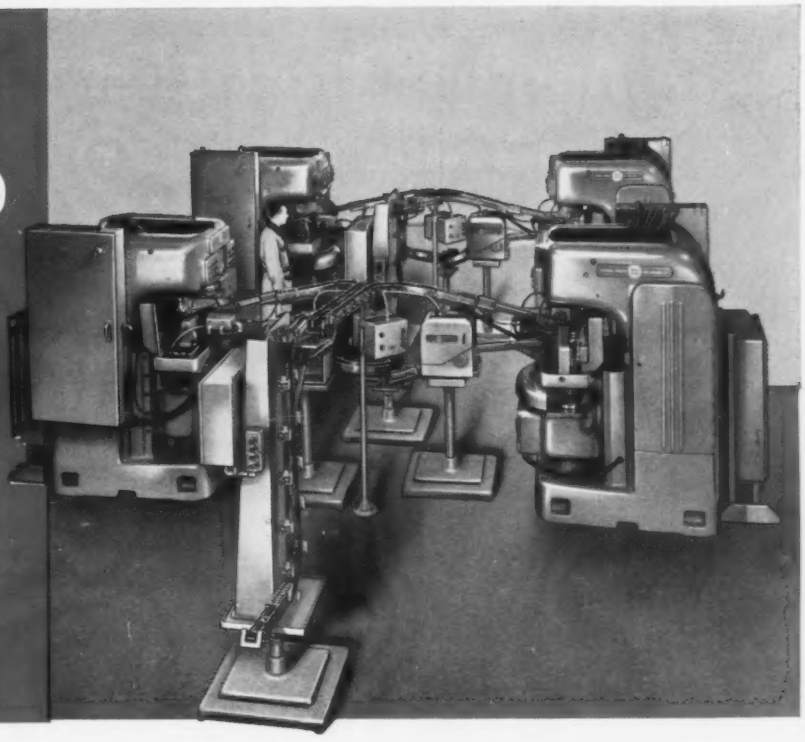
Jones & Lamson turret lathes are built and powered to produce *MORE CHIPS per tool*
MORE PIECES per hour
MORE PROFIT per job
than any other turret lathe of comparable size!

JONES & LAMSON

the man who needs a new machine tool is already paying for it

JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vt., U.S.A. J&L MACHINE TOOL DIV.

FULLY AUTOMATED GEAR SHAVING *CAN ALSO BE* PERFECTLY FLEXIBLE



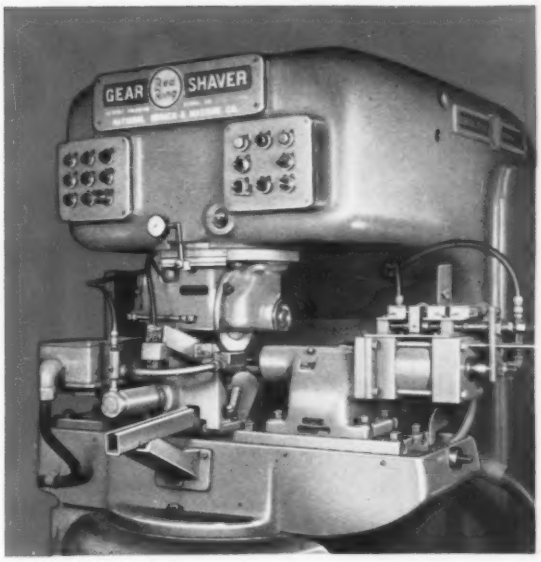
This fully automated installation shaves the split long pinion used in automatic transmissions. This pinion consists of two gear sections each of which is individually crown shaved. Output at full efficiency is 400 pinions (800 gear sections per hour).

The first pair of standard Red Ring Shaving machines processes one of the pinion sections. The second pair processes the other.

Automatic sizing gages perform a 100% check and reject any out-of-tolerance units.

Any individual shaving machine may be stopped at any time for cutter change or adjustment without interferring with the operation of the rest of the system. This is provided for by automatic switching in the feeder lines.

The flexibility of the supply and discharge lines greatly facilitate positioning the machines.



Write for further details.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

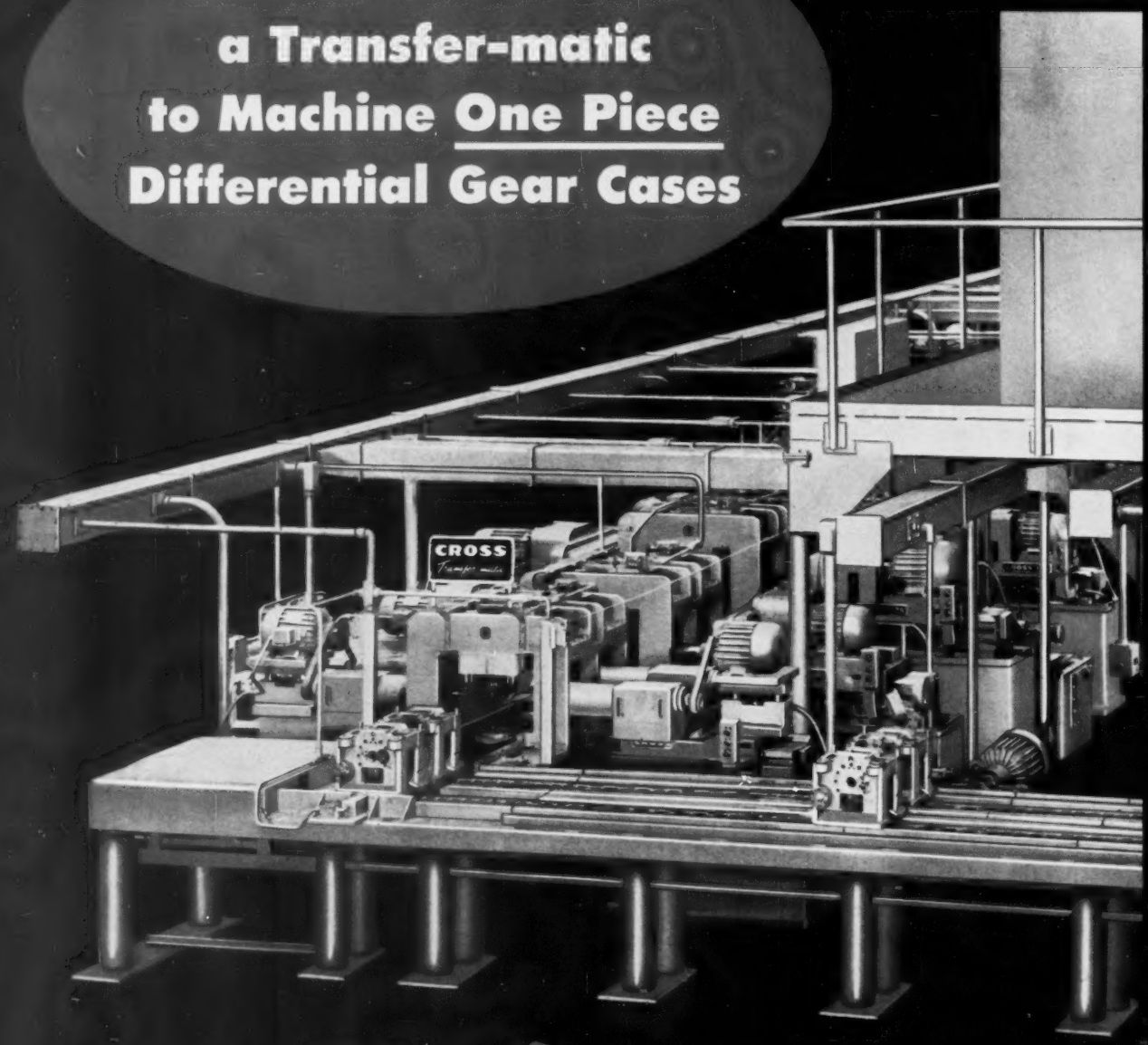
5600 ST. JEAN • DETROIT 13, MICHIGAN

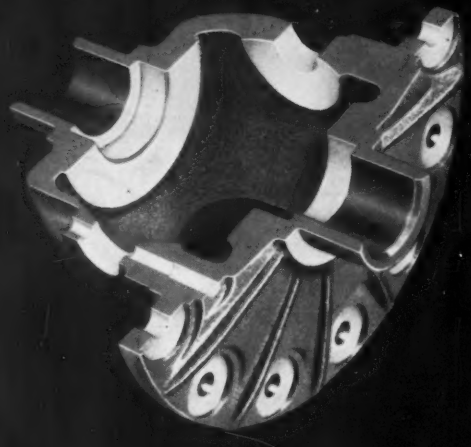
7788

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

For more information fill in page number on Inquiry Card, on page 229

Another Cross First – a Transfer-matic to Machine One Piece Differential Gear Cases





Cutaway view of differential gear case showing machined surfaces.

Established 1898

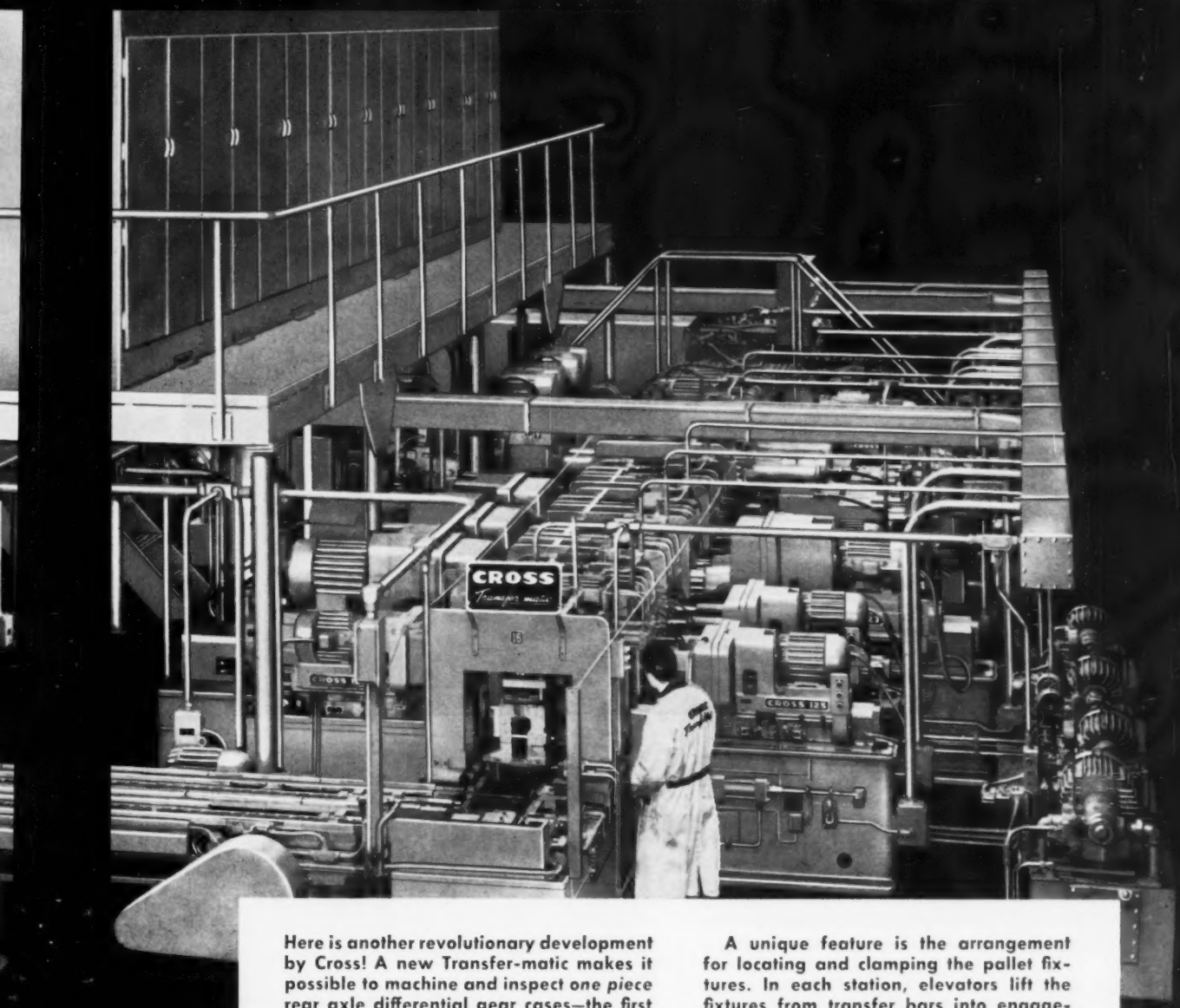
THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Combination spar and skin miller operating at one of the country's largest aircraft plants (Name on Request). *Texaco Soluble Oil* emulsions are used exclusively in these operations.

Another Transfer-matic by Cross



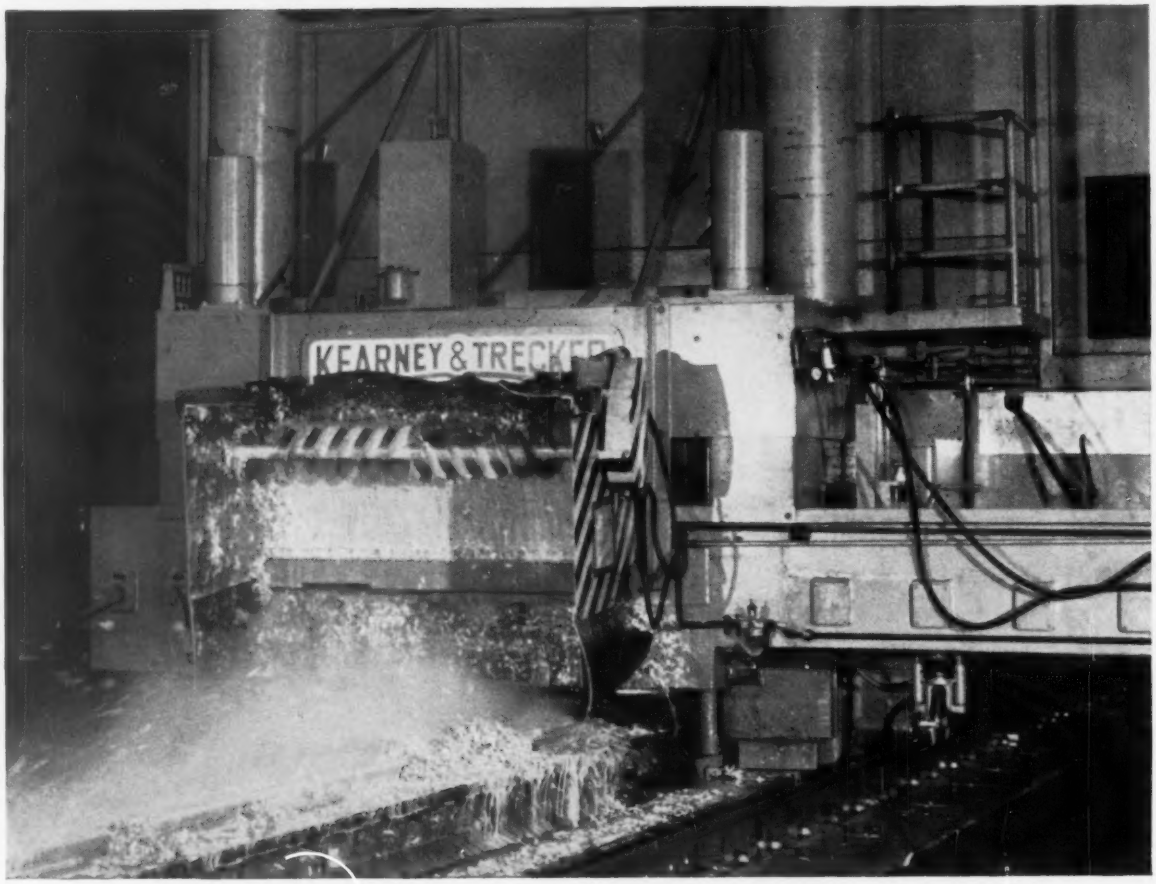
Here is another revolutionary development by Cross! A new Transfer-matic makes it possible to machine and inspect *one piece* rear axle differential gear cases—the first time such a part has been processed on a transfer machine.

Two cases are machined at a time as they travel a distance of 206 feet through 30 stations. Rated capacity is 212 pieces per hour at 100% efficiency. Operations include rough and finish forming the two spherical seats for the pinions; rough and finish boring and facing the two seats for the side gears; drilling, boring and reaming the pinion shaft hole; drilling and reaming the lock pin hole; drilling, chamfering, spotfacing and reaming the twelve ring gear mounting holes.

A unique feature is the arrangement for locating and clamping the pallet fixtures. In each station, elevators lift the fixtures from transfer bars into engagement with locating pins and stop buttons fixed in the overhead bridge structures. Individual wedges then back up the elevators to secure the pallets. After cutting, the elevators lower the pallets onto the transfer bars, which carry them to the next station.

Other features include construction to JIC Standards, hardened and ground ways, complete interchangeability of all standard and special parts, pre-set cutting tools and Cross Machine Control Units which program tool changes to reduce machine downtime.

Combination spar and skin miller operating at one of the country's largest aircraft plants (Name on Request). *Texaco Soluble Oil* emulsions are used exclusively in these operations.



How Texaco Soluble Oils combine cooling capacity with anti-friction properties

Soluble oil emulsions are often considered just "coolants", whereas cutting oils, by virtue of their extreme pressure and wetting properties are selected mainly to reduce friction.

But you can combine the advantages of good cooling capacity and excellent anti-friction properties, by using *Texaco Soluble Oil*. For heavy duty operations, emulsions of *Texaco Soluble Oil HD* also contain extreme pressure characteristics which make them suitable for many machining jobs that formerly could be handled only by cutting oils.

For grinding, *Texaco Soluble Oil* emulsions fight the common tendency for wheels to load—keep machines cleaner. They emulsify readily with water—remain stable. And they provide protection against rust, even at high dilution.

There is a *Texaco Cutting, Grinding* or *Soluble Oil* to help you do better, faster machining, at lower cost. Ask your Texaco Lubrication Engineer to help you select the proper one. Just call one of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO REG. T.M.

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

For more information fill in page number on Inquiry Card, on page 229

- Signals Crossed?
- Unfavorable Climate
- Defense Doings
- Washington Briefs

Keeping up with Washington

By Loring F. Overman

Recent Washington hassle over cutting the budget turned up some oddities.

National Association of Manufacturers, in its commendable program urging tax cuts, cited machine tool industry expansion program as typical example of government's expensive "crutches for business" activity. Reprinting excerpts from a Chicago *Daily News* analysis of the proposed 71.8 billion dollar budget, NAM included the following:

"Programs connected with defense production, particularly the stock-piling of strategic materials that Western mining interests find to be slow moving, offer surprising bits of information in the big budget book.

"One program for the expansion of machine tool producing capacity provides for installing, under lease, government-owned machine tools in the plants of private producers.

"Another paragraph on defense production reveals a program to round out capacity to produce steam turbines and turbine gears by installing machinery and equipment in plants of private contractors.

"It will come as no shock to the taxpayer that these programs are conducted at a loss out of the revolving fund used to build up stockpiles and to keep manufacturing facilities of private industry up to par.

"In 1956 these losses to the government totalled $19,700,000. In 1957 the loss will be $38,500,000. In 1958 the government expects to set a record, with a loss of $42,000,000 in conducting programs of all the defense production agencies."

Reacting to the press demand for economies, the House of Representatives halved Commerce Department's requests for funds to operate the Business Defense Services Administration. Pruning would cut off twenty-five BDSA industry divisions, including General Industrial Equipment Division, custodian of affairs of machine tool producers.

Unfavorable Climate

With stand-by programs in temporary disfavor, and economy drives threatening the Business Defense Services Administration's industry divisions, spring was an unfavorable time for the screw machine products industry to seek government aid. Industry members told government officials that financial assistance will be needed to acquire special purpose equipment if the industry's part of the program is to be maintained.

Screw Machine Products Advisory Committee told BDSA officials that few companies manufacturing screw machine products as consumer goods can afford to purchase single-purpose automatic screw machines or specialized heat-treating, plating, grinding, and polishing equipment. Machines are needed as stand-by installations, to be used in production of jet-aircraft and guided-missile parts in an emergency.

Defense Doings

New, numerically controlled profile and contour-milling machines were slated for tests by Wright-Patterson Air Force Base executives early in May. Tests were to be conducted at Fond du Lac and Milwaukee, Wis. Operated by signals on a magnetic tape, the machines are expected to hasten automation in the fabrication of complicated aircraft and missile parts.

New military standards for anti-friction airframe roller bearings are announced by the Defense Department Director of Standardization and Inspection. The new standards specify forty-seven standard types and sizes acceptable to Army, Navy, and Air Force for military use. The forty-seven replace 440 commercial types and sizes heretofore involved in DOD buying. Requirements are stated in Military Standards MS-24461-24466 and related specification MIL-B-3990.

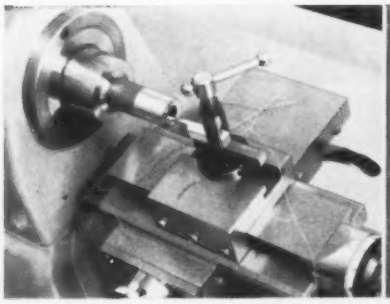
Washington Briefs

- Contract of $9,872,000 for a power plant for the first nuclear-propelled passenger-cargo vessel has been awarded. Unit is to develop 22,000 horsepower; is expected to be forerunner of a fleet of such ships. Babcock & Wilcox Co. holds the contract.
- Another new type marine power plant—a free-piston gas turbine—is to power a converted Liberty Ship. Maritime Administration is the buyer, Cleveland Diesel Engine Division of General Motors the supplier. Installation is expected to be 20 per cent more efficient than gas or steam turbine installations of equal size.
- Legislation to limit the life of a patent to twenty years is sponsored by Senators O'Mahoney (D-Wyo.) and Wiley (R-Wis.) Bill would limit life of a patent to a maximum of twenty years from date the application was filed, or seventeen years from date of issuance, whichever is shorter.

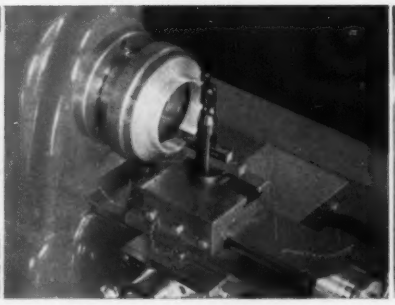
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

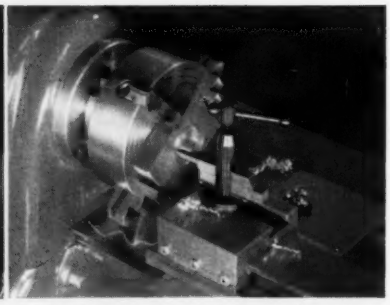
Correct Size - High Speed - Precision Results



Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".

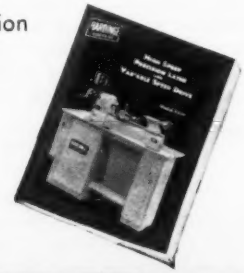


Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".

SPECIFICATIONS:
1 1/16" Collet Capacity
9" Swing
17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

The above three important requirements for proper lathe work in tool rooms, production departments, or laboratories are completely fulfilled by the new Hardinge DV59 High Speed Precision Lathe.

Correct size of the machine in relation to work saves loss from under-capacity production on larger lathes. High spindle speeds, up to 3500 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results



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"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

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Machinery
JUNE 1957

Are There Really Obstacles to Hiring Older Workers?

LACK of skilled workers is an everyday problem on the industrial scene. Particularly in the metalworking industry there is generally a dearth of experienced toolmakers and diemakers. This is often a serious problem, because high-production and automated equipment cannot function satisfactorily unless it is provided with complex and accurate tooling.

The importance of training apprentices to replace superannuated employes has long been recognized. Today, many communities, labor unions, and local industries, acting individually or in concert, sponsor vocational education programs. Unfortunately, the number of young men acquiring formal trade training is far below industry's expanding requirements, so through superannuation, the skilled manpower pool continues to shrink. A second source of skilled labor, one never fully tapped because of prejudices and misconceptions, is the older worker who, because of the caprices of the business world, finds himself in the available labor market.

Many such men, in their forties, fifties, and sixties, have the high degree of skill that is the exclusive possession of those who have spent long years at the bench or machine. Their adjustment to the environs of a new shop is often rapid and totally satisfactory.

Even though there may be no provision in a union contract abrogating or abridging management's prerogatives in hiring, there still exists considerable hesitancy in employing older workers. Does the contract permit the older worker to be shifted to an easier and less remunerative job if his health later fails, or is the employer bound by some seniority clause? Will pension and group insurance costs rise because older workers have been employed?

The collective bargaining agreement is essentially a device for protecting the wage and job of the employe. Since the rate is generally set for the job rather than for the individual worker, the older (and presumably slower) worker conceivably is more costly to hire. Some contracts recognize this point and contain rate clauses for the older worker as well as the physically handicapped worker.

While it is patently true that the new employe's age has a direct bearing on the size of the contribution of the company to its pension fund, it is not axiomatic that the pension for the older worker will cost more. The real cost of the pension is not the current contribution, but the amount that is ultimately paid to the individual. Evidence indicates that the amount finally paid to the man hired young will be much higher in proportion to current pension costs than the amount finally paid to the man hired when older.

Some companies use men older than the traditional retirement age of sixty-five years to train apprentices in machine shops and drafting departments, with gratifying results. These older men are proud to have the opportunity of gainful employment and of passing on their experience to the future skilled men of industry.

The question of whether a man is "too old to work" should not necessarily be tied to an average age, but should be based on his mental and physical capacities.

Charles O. Herb

EDITOR

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Improved Production of Direct-Current Motors and Generators

By G. William Ambro, Manager
Department Advance Manufacturing Engineering
Direct-Current Motor and Generator Department
General Electric Co.
Erie, Pa.

INCREASING applications of automated processes have heightened the demand for direct-current electrical equipment. Direct current is preferred for automation devices because of its adjustable speed characteristics and the fact that it can be precisely controlled. Drives of this type give high starting torques. They can be programmed to control a machine's operation or to regulate its production by means of feedback. This leads to increased output, better quality control, flexibility of production, and lower costs.

To meet the need for more direct-current motors and generators, the General Electric Co. has undertaken a $20,000,000 expansion

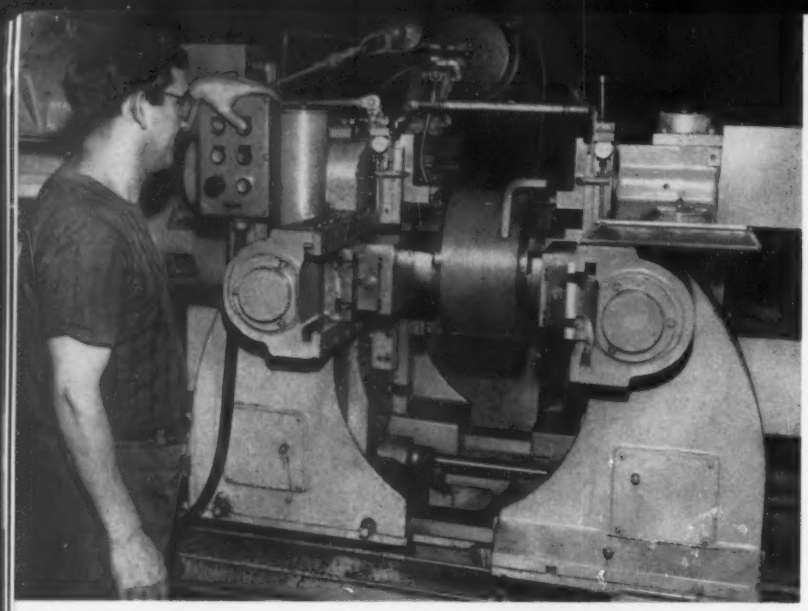


Fig. 1. To insure a good fit of the end shields and a uniform air gap at assembly, both ends of the frame are machined at the same time.

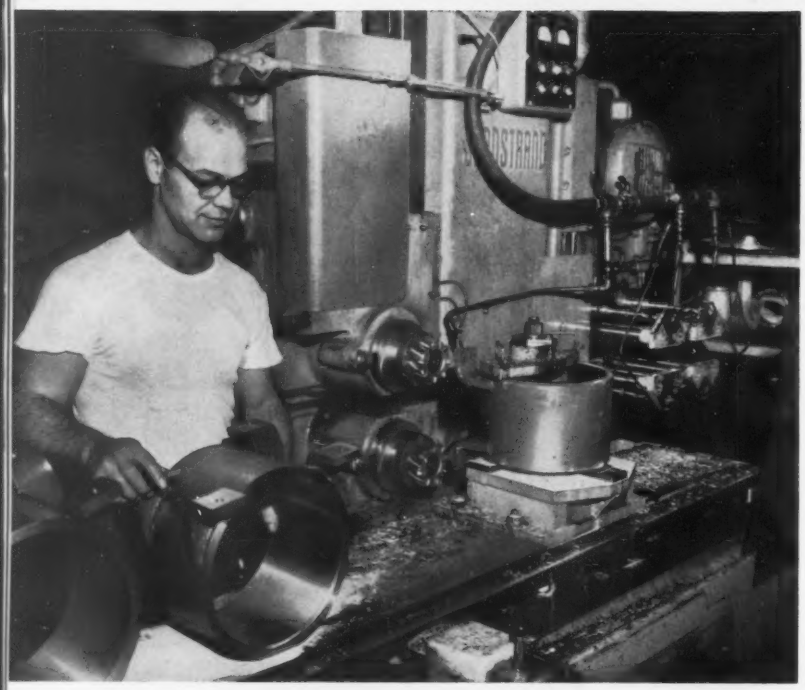


Fig. 2. Frame feet are milled to height and drilled on this automatic cycling machine. Spindles are quickly adjustable to handle various size frames.

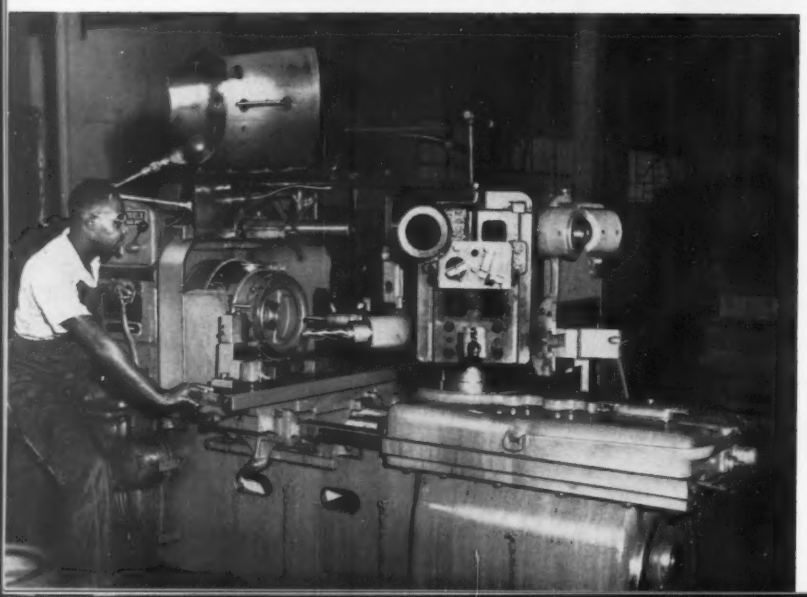


Fig. 3. Automatic cycling, chucking turret lathe for drilling, boring, reaming, facing, turning, and chamfering cast-iron end shields for motors and generators.

Fig. 4. Special three-way, rotary machine for drilling and tapping bearing-cap, hand-cover, magnet-frame mounting, and brush-rigging holes.

and modernization program at its Erie, Pa., plant. Also, large-scale relocation of production facilities has been completed recently, bringing together at Erie all of the integral horsepower direct-current manufacturing operations formerly located at Fort Wayne, Ind.; Lynn, Mass.; and Erie.

One entire building is being utilized for the production of the new Kinamatic line of direct-current motors having ratings from 1 to 150 hp at 1750 rpm, and generators from 3/4 to 100 kw. These units show substantially improved performance characteristics from previous designs and are built specifically to utilize the feed-back control so necessary in automation. By combining advanced design with improved materials and manufacturing techniques, it has been possible to pack more power per frame size into the entire Kinamatic line.

Cylindrical frames for the smaller Kinamatic units, varying from approximately 9 to 14 inches in diameter, are formed from flat plates on the Lake Erie bulldozer seen in the heading illustration. The developed-shape blanks are burned from large flat plates by means of oxy-acetylene torches. Progressive forming is accomplished by step-feeding the blank between die and punch.

The concave die member is mounted on the horizontal-acting machine cross-head. Movement of the cross-head is controlled by a foot-treadle. When the operator removes his foot from the treadle, the stroke is stopped and the head returns to its starting position. The punch consists of a formed ring mounted on a stationary vertical post at the left-hand end of the machine. Both the punch and die can be changed quickly for forming other size frames.

An arc welder is provided at the bulldozer to manually tack certain size frames that have a tendency to spring back. The same machine is used to crimp both ends of larger size frames (16 through 25 inches in diameter) prior to roll-forming. This eliminates the formation of flat spots where the ends come together during roll-forming.

Frames are completely machined on a semi-automated line containing six machine tools in a circular arrangement. First, the field pole surfaces of the frames are rough- and finish-bored on a Gisholt automatic cycling production lathe. Carboloy tooling is employed to rough-bore the frames at a cutting speed of 300 feet per minute. Similar tooling is used to finish-bore the frames at 600 feet per minute.

Then, both ends of the frame are machined simultaneously on the Gisholt Simplimatic lathe seen in Fig 1. By facing and boring the two ends of each frame at the same time, a uniform air gap is insured. Also, concentricity, parallelism, and precise alignment of the end shields are obtained at assembly. The work-piece is located and held on an expanding arbor. Tools on the two rear slides rough-face and chamfer both ends of the frame, and then front-slide tools finish-face these surfaces. Simultaneously, tools on the two lower, vertical moving slides rough-bore and chamfer the rabbet-fit surfaces at both ends of the frame. These surfaces are finish-bored by tools on the two upper, vertical-moving slides. Carboloy tools are used for roughing, with a cutting speed of 270 feet per minute, and at 300 feet per minute for finishing. Facing tools are fed at the rate of 0.015 inch per revolution and boring tools at 0.010 and 0.012 inch per revolution.

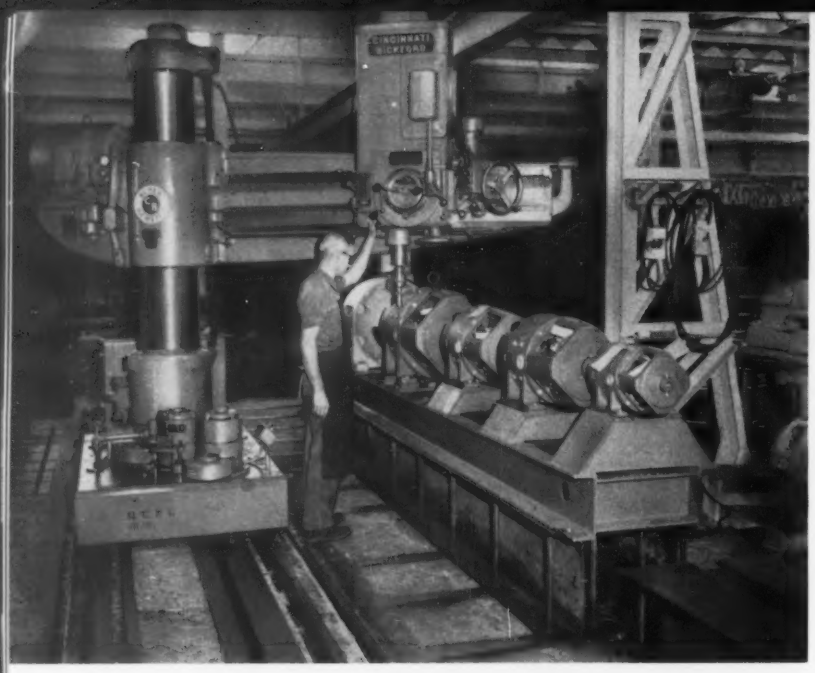


Fig. 5. Radial drilling machine having a 6-foot arm is mounted on track rails to facilitate drilling and tapping holes in various sizes of motor and generator bases.

The frames are both milled and drilled on a special Sundstrand machine, Fig. 2. At the first station, the frame feet are milled to the required height by means of two eight-bladed milling cutters, 4 1/2 inches in diameter. After being automatically indexed to the second station, the four mounting holes (one in each foot) are drilled. All spindles are adjustable both vertically and horizontally so that change-over to the production of other frame sizes can be made quickly. The work-holding fixture is designed to accommodate various size frames and need not be changed.

A special W. F. & John Barnes machine is used to drill, countersink, and tap eight holes in each frame for attaching the end shields. On a similar machine, holes for the conduit-box adapters are drilled and tapped. Four nameplate holes and the pole-mounting holes (eight in the two-pole frames, and sixteen in the four-pole frames) are drilled on a machine made by the Hartford Special Machinery Co. Cast-iron end shields for the Kinamatic motors and generators are also machined on a semi-automated line, this one consisting of three machine tools. First, the castings are drilled, reamed, bored, faced, turned, and chamfered on a Potter & Johnston automatic chucking turret lathe, Fig. 3. In the case of end shields for one particular frame size, with the work rotating at 466 rpm, a 13/16-inch diameter core-drill mounted on the first turret position is fed through the part at the rate of 0.023 inch per revolution. The shaft bearing surface is rough-bored with a single-point tool mounted on the second turret position. While the work speed remains the same, the boring tool is fed at the rate of 0.015 inch per revolution.

Tooling on the third turret position is fed at 0.015 inch per revolution to rough-face the brush rigging surface, bearing cap, and end face of the casting. Simultaneously, a tool on the front cross-slide rough-faces the rabbet-fit surfaces. For

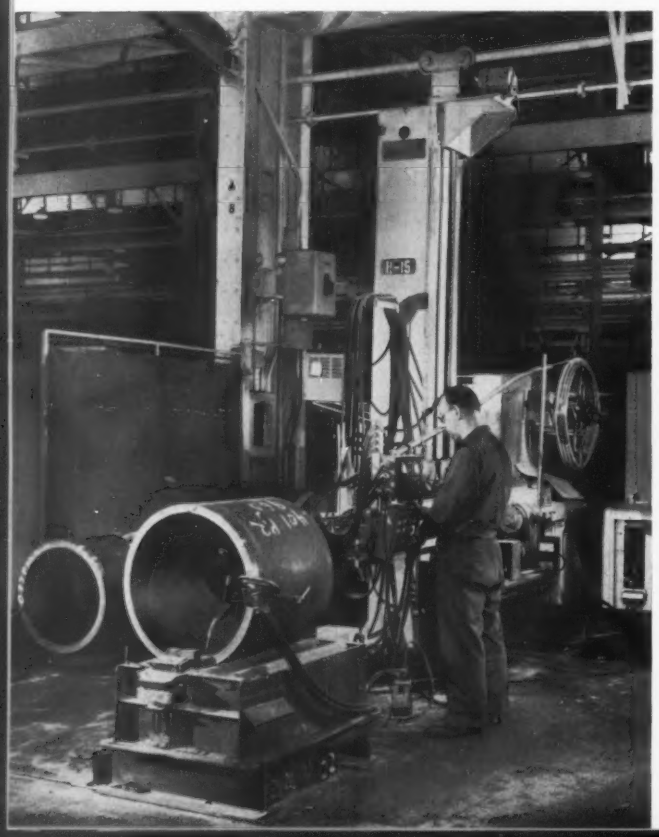


Fig. 6. Ram type submerged-arc welding machine for joining ends of roll-formed frames made from 1 1/2- to 3 1/4-inch thick mild steel at rates up to 10 inches per minute.

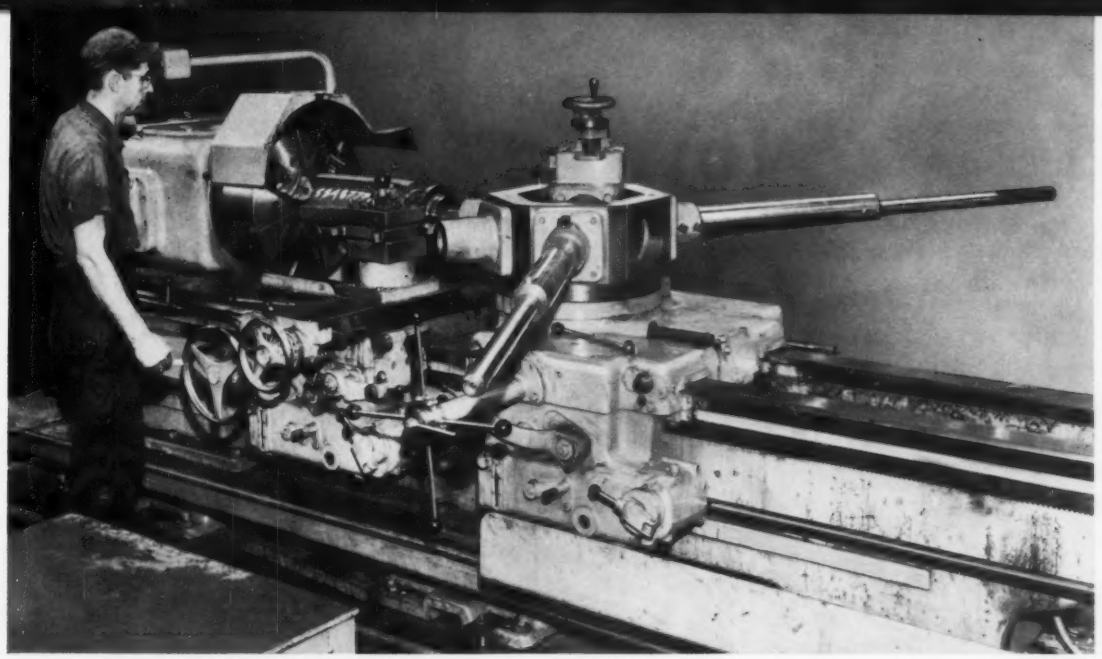


Fig. 7. Armature spiders up to 18 inches in diameter by 36 inches long are turned, faced, and rough- and finish-bored on this universal turret lathe.

these operations, the work speed is automatically reduced to 142 rpm. Four tools are provided on the fourth turret face for semifinish-boring the rabbet, shaft, and bearing surfaces, as well as chamfering the bearing bore. Here, the work speed is again 466 rpm, while the tools are fed at the rate of 0.009 inch per revolution.

Finish-facing of the brush rigging surface, bearing cap, end face, and rabbet-fit surface is done with tools on the fifth turret face and rear cross-slide. Tooling at the sixth turret face is used to finish-turn and chamfer the rabbet, finish-turn the brush rigging surface, and ream the shaft and bearing bores. For these operations, the work is rotated at 142 rpm and the tools fed at the rate of 0.009 inch per revolution.

Various holes in the end shields are drilled and tapped on the special W. F. & John Barnes indexing machine seen in Fig. 4. The sixteen hand-cover holes in each commutator end shield are drilled by tools mounted on the left-hand angular head and tapped with the right-hand angular head. These operations are performed four holes at a time, with the rotary table being automatically indexed four times to complete the part. Tooling on the vertical head drills four magnet-frame mounting holes, drills and taps four brush-rigging holes, and drills and taps four bearing-cap holes. Two grease fitting holes on the outside of the bearing bracket are drilled and tapped on a Rehnberg-Jacobson machine.

Flexibility has been achieved in drilling and tapping foot-mounting holes in various size motor and generator bases by mounting the machine on track rails, Fig. 5. The portable machine is a Cincinnati Bickford 6-foot arm, radial drill. Fabricated bases up to 27 feet long can be handled with this setup. Smaller bases are clamped to tables, while the larger bases are merely set on the floor without clamping.

Larger direct-current motors (200 to 700 hp at 1750 rpm) and generators (125 to 500 kw), as well as dynamometers and exciters, are produced in a separate building at the Erie facility. Frames for the larger motors and generators are roll-formed from flat mild-steel plates, up to 3 1/4 inches thick, with 45- to 60-degree angle, beveled mating ends. The frames vary from 22 to 56 inches in diameter, and from 12 to 30 inches in length.

Frame ends are joined on a Peck universal, ram type welding machine, Fig. 6, using a Linde Unionmelt submerged-arc welding head and wire feed unit. Power is supplied from four General Electric 500-ampere, alternating-current arc welders. Copper-coated, mild steel wire, 5/16 inch in diameter, is automatically fed from a spool seen at the right-hand end of the machine. Frames made from 1 1/2- to 2 1/2-inch thick plates are welded at 38 to 40 volts and 1300 amperes, while thicker frames (up to 3 1/4 inches) are welded at 1500 amperes with the same voltage.

Welding speed can be varied from 2 to 20 inches per minute, with a rapid return being provided for all speeds. Inside welds are usually made at speeds varying from 6 to 8 inches per minute, while outside welds are performed faster —9 to 10 inches per minute. The welds are completed in one pass with penetration up to 1 inch

per side. On a typical frame having an outside diameter of 51 5/8 inches, a bore of 45 5/8 inches, and a thickness of 3 inches, the inner weld corresponds to a 5/8-inch fillet, and the outer weld to a 7/8-inch fillet.

Armature spiders for the direct-current motors and generators are either iron castings or steel weldments. The spiders (up to 18 inches in diameter by 36 inches long) are turned, faced, and rough- and finish-bored on a Jones & Lamson No. 10A universal turret lathe, Fig. 7. The power available on this machine, combined with Carboloy tooling, permits turning at speeds up to 300 feet per minute, with a feed of 0.011 inch per revolution and a depth of cut of 1/4 inch.

Milling of keyways in the shafts is done on the Ingersoll machine shown in Fig. 8, which consists essentially of a traversing work-table mounted on the machine bed and a vertical housing having two adjustable saddles. One saddle contains a vertical spindle, and the other, a horizontal spindle, so that different type keyways can be milled in the same setup. Shafts up to 12 inches in diameter are mounted in a fixture on the work-table, and parts up to 24 inches in diameter can be clamped directly on the table without a fixture.

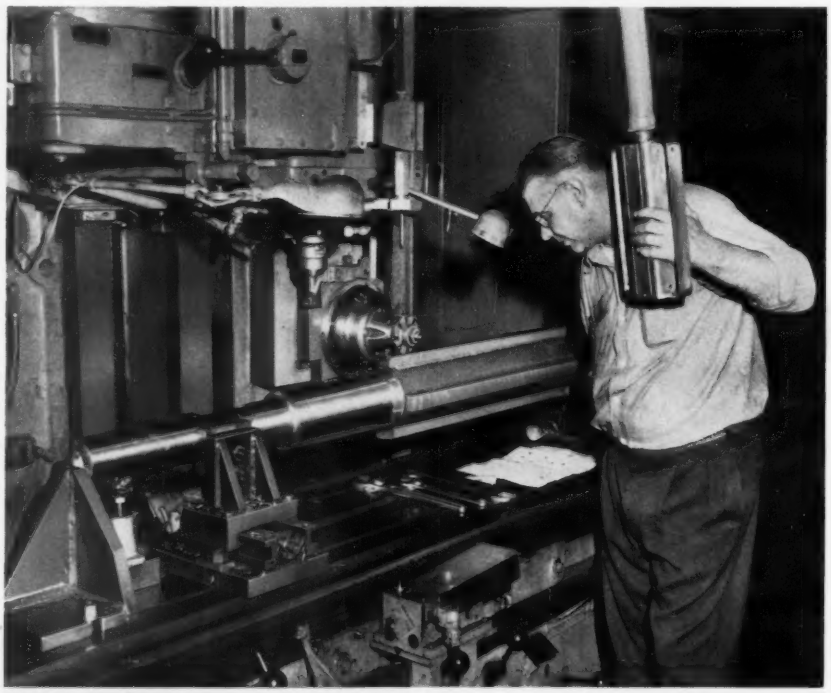


Fig. 8. (Right) Special milling machine provided with both horizontal and vertical spindles for cutting various type keyways in shafts up to 12 feet in length.

Fig. 9. (Left) Bearing supports are hardened and commutator connections of aircraft generator exciters are brazed on this two-station induction heating machine.

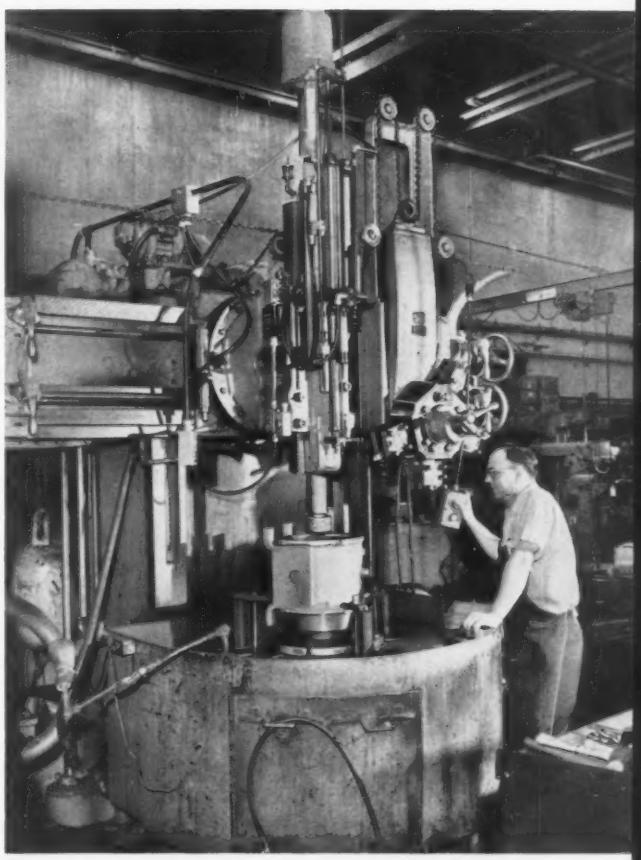


Fig. 10. Special grinding attachment on this vertical turret lathe permits finishing bores in same setup used for the machining of end shield fit surfaces.

Keyways from 3/16 to 2 1/2 inches wide and up to 36 inches long are milled in shafts having a maximum length of 12 feet.

A keyway 5/16 inch deep by 5/8 inch wide and 33 inches long is being milled in the 8-foot long shaft illustrated. Speed of the horizontal spindle, which is powered by a 20-hp motor, is adjustable from 18 to 340 rpm, and the vertical spindle (5 hp), from 98 to 1000 rpm. Feed rates can be varied from 1/2 to 24 inches per minute, with a fast traverse of 24 feet per minute. By using insert type, Carboloy blade cutters, cutting speeds up to 300 feet per minute are possible.

Aircraft generators are produced in two bays of a third building at the Erie facility. Among the interesting operations performed here are the induction hardening of bearing supports and the brazing of commutator connections. Both these functions are performed on a General Electric two-station, 50-kw, 500-kc induction heater, see Fig. 9. Hardening of the 3/4-inch wide seats on SAE 4140 steel bearing supports is done at the station seen at the left. The work-piece is rotated and elevated into position, heated to a minimum temperature of 1550 degrees F. for about three seconds, and water-quenched for two seconds. This produces a hardness of 48-52 Rockwell C, with a case depth of from 0.030 to 0.060 inch.

At the second station, seen directly in front of the operator, the exciter leads of aircraft generator exciters are induction brazed to the commutator risers. Prior to brazing, brazing alloy in punched sections is manually prepositioned during the winding operation. Since a copper-to-copper braze is made, no flux is required. The assembly is placed between centers, with one center being power-driven through a gear speed reducer from an electric motor. An Eastman Kodak Ektron radiation type, temperature-sensitive cell is directed onto the area being inductively heated. The cell is connected through a General Electric Thy-mo-trol electronic control unit to the motor so that when the temperature reaches 1500 degrees F., the generator assembly is slowly rotated. Brazing is completed in one revolution of the aircraft generator exciter. Heat transfer to the commutator and conductors is minimized by water cooling.

To maintain the concentricity of amplidyne unit bores (with relation to the end shield fit surfaces) within close tolerances, the bores are ground and the end shield surfaces machined in the same setup. This is accomplished by mounting a General Electric-built grinding attachment on a King 42-inch vertical boring mill, Fig. 10. The amplidyne bore is made up of a series of 0.014-inch thick laminations. It is essential that these laminations not be rolled over during grinding, since this would cause short-circuiting. Standard grinding attachments mounted on the machine turret head have not proved satisfactory.

The ram-head of the vertical boring mill was bored to accommodate a 3 1/2-inch diameter quill and equipped with a Bellows power unit consisting of one air and two hydraulic cylinders and the necessary controls. This arrangement is used to reciprocate the spindle at a rate of 15 to 20 inches per minute through an adjustable, 18-inch maximum stroke. The spindle is rotated at 3450 rpm by a 3-hp motor.

A vitrified-bond, aluminum-oxide abrasive wheel, 5 inches in diameter by 1 1/2 inches wide, is used for this operation. The work-piece bores vary from 6 to 11 inches in diameter. Approximately 0.030 inch of stock is removed from each bore, with the wheel being advanced 0.002 inch after every three strokes of the spindle. Work speed varies with the size of the part, amplidyne units having a 7-inch diameter bore being rotated at 30 rpm.

A Machine Shop Teacher Appraises His Profession

No longer a commodity we readily import, our pool of metalworking tradesmen continues to shrink as efforts to produce skills at home fall short of industry's needs. Thirty-four-year-old Dick Outcalt, by trade a jig-borer operator, has been a machine shop teacher in Indiana for about two years. With none of the convictions of the dyed-in-the-wool pedagogue, he offers some practical solutions to the problems of poor equipment, lackadaisical students, and underpaid teachers.

By RICHARD M. OUTCALT
Instructor, Vocational Machine Shop
Martinsville High School
Martinsville, Ind.

INDUSTRY, continuing the pattern of previous years, will lose in 1957 about 5 per cent of its skilled tool and diemakers and machinists due to deaths, retirement, and occupational changes. Various sources indicate that only a fraction of these will be replaced by apprentices. Since industry expands with the growth of our population, we are not confronted with a static situation but must think in terms of future needs. When viewed in this light, the situation is even more critical than appears at first glance.

Skills Must be Acquired Here, Not Imported

In the past, the United States has derived a substantial share of its skilled labor from Old World craftsmen, but this is no longer the case. Coming generations of toolmakers and machinists must virtually all be trained here. It is going to be costly. This fact should be faced immediately: to avoid or seriously delay such training is tantamount to national suicide.

Who should pay for the training? What is the best way to conduct it? These questions naturally spring to mind. As to who should pay—it seems reasonable to assume that all who gain from such a program should be interested in contributing to it: the recipients of the training, who stand to reap the rewards that come to skilled men; industry, which must have these skilled men; and the nation as a whole, which depends on a healthy industry and also obtains greater tax revenue from a better-trained citizenry.

Many academic high schools have courses in machine shop theory and practice. Students often spend three hours daily in the shop and take related training during other parts of the school day. The courses attempt to prepare the students for useful employment, and should not be confused with one-hour industrial arts courses, which do not have a job-training objective. Students usually take the industrial arts courses upon entering high school and then a certain few elect to continue with vocational training in their junior and senior years. (State laws generally specify that the student be sixteen years of age, or very close to it, before he is permitted to take vocational machine shop training.)

School machine shops vary tremendously in quality and quantity of physical equipment. There was a good deal of surplus machinery on the market after World War II, but unfortunately, not enough of it found its way to the schools. Many shops have only a few 9-inch lathes and a drill press. Other shops are splendidly equipped, thanks to solid support from the school system and the community.

To bring the flavor of industry to the shop classroom, the instructor is required by law to be a tradesman. One to nine years of practical experience are demanded by the various states as a prerequisite to securing a license to teach vocational education. The instructor must also learn

how to teach, so he is generally required to take courses in education. He is also, of necessity, his own machine repairman (no minor chore with student machinists and old equipment), millwright, electrician, purchasing agent, and business manager. Like other faculty members, he may be called on to collect basketball tickets, handle football crowds, or chaperon school dances as a condition of his employment.

A recent article in Coronet magazine entitled "The Soviet Tekhnikum: Ominous Threat to the West," told what Russia is doing to increase its pool of skilled labor. Over one thousand technical schools now offer two and one-half year courses above the high school level. Apparently, no expense is spared to equip these schools. There are no tuition fees and, in addition, scholarships are available.

The high school vocational education program is the only thing we have to any substantial degree comparable to the tekhnikum. While vocational education has had federal assistance, since 1917 under the Smith-Hughes Act and later legislation, individual programs sometimes have difficulty getting much local support, let alone any adequate state or federal help.

Schools Cannot Absorb Equipment Costs

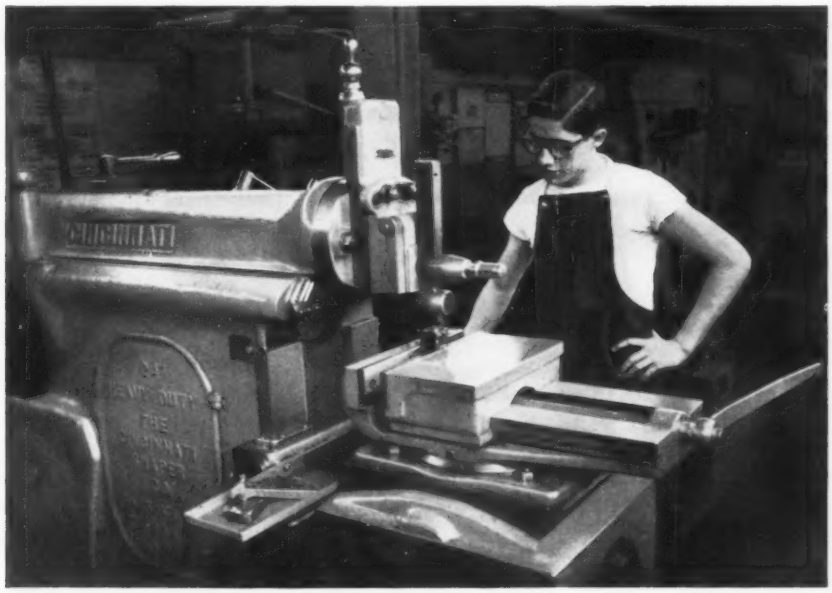
To meet present and future needs, more vocational machine shops must be created, especially in communities near industrial areas. Local school systems should underwrite the instructors' salaries, and might be expected to provide the floor space for the shop. Usually, however, the schools cannot afford the initial $20,000 to $30,000 necessary to equip the shop properly. Here, industry can help.

Technically outmoded equipment, or equipment that is inefficient by today's production standards but in good repair and still serviceable, might be donated by industry. Or light-duty, new equipment might be purchased by interested firms and loaned to the shops. All such equipment should have placards attached carrying this message: "This machine loaned (or presented) to X High School by the Y Mfg. Co. to train our nation's future craftsmen."

Obviously, there is a limit to which industry can contribute financially, but if industry cannot get its craftsmen in the future, that eventuality, too, will be costly. This approach may not work everywhere, but it has already proved successful in some communities.

The Indiana State Chamber of Commerce recently brought the problem of training youth to public attention in the form of a proposed amendment to the state's Vocational Education Act. The amendment authorizes and encourages cooperative programs between schools and employers—the schools teaching the related subjects, and the employers furnishing the technical facilities and the trade instructors. Students could be paid a token salary after filing certain

All the heavier machines like this 24-inch shaper are war surplus. The shop is located beneath the grandstand in the school's gymnasium.



Students inspect small parts made for a local concern. The class uses money earned in this way to finance field trips to industry.

papers with the government which would exempt the employer from compliance with the minimum wage provision of one dollar an hour. The proposed amendment seeks to assist communities where a vocational education program would not be possible otherwise.

Our existing vocational machine shop courses must be strengthened in physical equipment, in their stature in the educational system, in the type of student they attract, and in the quality of the instruction offered. As mentioned before, many school shops lack an adequate assortment of machine tools. Where this situation exists, interested local industries might, for example, get a vertical milling machine or a small surface grinder for the shop.

The Above-Average Boy is Discouraged

Administrators and guidance personnel generally do a good job of counseling students, yet too often a boy is placed in a vocational program because he is a disciplinary problem or a dullard. Many sincere educators consider the vocational shops a legitimate outlet for a difficult boy. The result is to impose one more duty on the tradesman instructor—that of policeman. He is forced to be ever watchful for breaches in discipline. And to make matters worse, the student has mobility in the shop, whereas in the academic classroom he has an assigned seat. Naturally, the instructor's efficiency (and temper) suffer in the bargain.

It also follows that if preponderantly below-average students gravitate to the shop, an above-average boy might avoid taking a course in which he would otherwise be very interested. It is an uphill struggle to resurrect a vocational program that has fallen victim to such a policy—a struggle in which the instructor can use all the outside help he can get.

No Inducement to Teach

Salaries are generally more favorable for vocational teachers—a concession to their scarcity—but they still receive considerably less than they can earn in industry. Because of the unattractive pay rate and the many problems confronting him, the vocational teacher often has better academic than technical qualifications. Many are licensed with the benefit of a good deal of imagination about their trade qualifications. A skilled artisan joining the ranks of machine shop teachers after the required number of years of industrial experience must be prepared to take a drop in pay of as much as $4000 a year. This is a large sacrifice to make, to experience the "rewards" of teaching.

Some solutions are proposed here. The teacher can be paid his regular salary by the school system, plus a differential from some other source. Or, an interested firm might grant a year's leave of absence to one of its toolmakers to the school system, contributing the pay differential so that he experiences no drop in income. Another ap-

proach might be for companies to send their top-flight toolmakers and machinists, one at a time on a rotating basis, to the schools to work with the regular instructor one or two days a week. They could coach the boys individually, as the instructor does, and in the process do much to add to the technical knowledge of the instructor. Most instructors would be enthusiastic about receiving this kind of help, and the relationship would also bring new awareness to industry of the shop teacher's problems.

To alleviate the present critical shortage of trainees, interest in the trade should be stimulated in youth who would otherwise be unaware of its opportunities. We should recruit the above-average boy who can justify the heavy investment needed in vocational education programs. We cannot justify two years of training if our graduates simply are to go forth and push buttons on transfer machines.

Ideally, we should furnish industry with "advanced learners" as apprentice material. We should strive for a 100 per cent placement of graduates in metalworking occupations, and should not accept students, however well qualified, who contemplate other pursuits. Finally, it should be remembered that the three hours of trade instruction for each of the 177 days in the school year totals 531 hours—the equivalent of three months in industry at eight hours daily. We cannot, therefore, expect more than three months of preparation toward an apprenticeship for each year of high school training.

Opportunities in Metalworking Need Publicizing

If the machine shop programs are to attract a greater percentage of students of apprenticeship caliber, the guidance people in the high schools need to be re-oriented in their thinking about the opportunities metalworking offers. Many companies find that a good number of their apprentices rise rapidly to supervisory positions. A recent survey of 1940-41 apprenticeship graduates revealed that of the 85 per cent still in trade-related areas, 43 per cent had risen to management positions, and 10 per cent were in top-level, high-income management. Is it realistic guidance, then, which fills school shops with students who rank on the average in the bottom quarter of their grade level? We who are interested in metalworking must do a better job of reaching guidance personnel, and we must also do a better job of reaching the student with the right kind of information before he chooses his vocational studies.

Education Departments Need Technical Specialists

More money must be spent at the state level. Every state has a vocational education department, but most suffer from inadequate appropriations. A real help would be the creation of a separate committee for each vocational field of importance in the state. In the case of the vocational machine shop, a good committee might include influential management men who are former toolmakers or machinists.

This kind of a committee would best appreciate the urgency of the present situation. Their liaison with the educational system could be through a technical specialist with an office in the state vocational education department. The specialist would be capable of giving shop instructors help in the areas in which they are weak. He would also unify training objectives in the state, formulating a model training plan.

Also, the technical specialist could edit a monthly newsletter containing suggestions and shop tips for the instructor. He could arrange to have technical representatives of machine tool and equipment manufacturers aid in-service training by giving lectures and demonstrations at regional vocational meetings. Working with his committee from industry, he would direct the recruiting of qualified instructors. It would likewise be the specialist's duty to recommend, in extreme cases, the replacement of an instructor unwilling to progress with the times, or one totally unfit for teaching.

The specialist could allocate and distribute surplus items from state depots, such as making certain that each vocational machine shop having a vertical milling machine got its fair share of end mills as such cutters come into the depot. In turn, specialists of the various states might work as a group to encourage release to the schools of any federally owned machine tools that are presently in storage or about to be declared surplus.

By
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Which Type Wheel for Surface Grinding?

SURFACE grinding—the name applied to the grinding of flat surfaces—is generally performed with the peripheries of straight abrasive wheels, the sides of cup or cylinder wheels, or abrasive segments. The accuracy that can be maintained with peripheral grinding makes straight wheels preferable for toolroom and close-tolerance work. However, stock removal rates with this type wheel are comparatively low.

Segments or cylinder (ring) wheels are generally recognized as the best abrasive tools for fast metal removal in surface grinding operations because maximum utilization is made of the grain cutting edges. This is illustrated diagrammatically in Fig. 1. With a straight wheel (right), one side of each abrasive grain contacts the workpiece only after traveling 360 degrees. However, with a ring-wheel or segments (left) on a workpiece larger in diameter than the wheel, various cutting edges of the abrasive grain are in contact with the part through an arc of about 180 degrees or more.

Both segments and ring-wheels have certain relative advantages for specific applications. Ring-wheels are usually recommended when a smooth surface is specified or when small workpieces must remain rigid in the grinding machine chuck. It is easier to generate a fine finish on the work with the continuous surface of a ring-wheel. Due to continuous contact between wheel and work, and the even pressure exerted, it is easier to hold small pieces and nonmagnetic parts on the chuck with ring-wheels.

However, abrasive segments have a cooler cutting action, are easier to mount, and are definitely superior from the standpoints of metal removal rates and costs. The average cost of most ring-wheels is approximately one-third higher than that of comparable segmented wheels. In other words, there is about one-third more usable abrasive for the same money when segments are employed.

Comparison tests are valuable in appraising stock removal rates and relative costs of different wheels. However, care must be exercised to take into account all variable factors so that the results of successive tests can be compared fairly. The accompanying data sheet lists most of these fac-

tors and should be helpful in keeping information from various tests.

If possible, the same size work-pieces should be used for successive tests, and they should be spaced in identical locations on the chuck. Down feed rates, the total down feed, and machine table speeds should also be the same for a series of tests. The initial run of a wheel or set of segments should not be considered in the test data. More uniform results will be obtained after break-in, when the full face of the wheel or set is cutting.

Several methods of evaluating test results are possible. With one method, the abrasive loss (in linear inches) from the segments or wheel is compared. This system is particularly satisfactory if the same size work-piece is being repetitively ground and if the same feed and table speed are used. The segment loss is determined by subtracting the measured stock removal from the observed down feed.

For example, one test was conducted on a 20 by 20 inch work-piece, with a down feed rate of 0.016 inch per minute. The test was completed in three minutes, and the segment loss was calculated as follows:

Observed machine down feed, inch	0.048
Less the measured stock removal, inch	0.025
Segment loss, inch	0.023

A second evaluation method takes into account the ratio of the amount of metal removed to the amount of abrasive used. This system is recommended when the size of the work-pieces varies from test to test. For the example described, the amount of metal removed equals 400 (the cross-sectional area of the 20 by 20 inch part in square inches) times 0.025 (the measured stock removal in inches), or 10 cubic inches.

The set of eight abrasive segments employed for this test had approximately 54.9 square inches of grinding area on their faces. This multiplied by the segment loss (0.023 inch) equals 1.26 cubic inches of abrasive used. Then, dividing the 10 cubic inches of metal removed by the 1.26 cubic inches of abrasive used gives a metal-to-abrasive ratio, by volume, of 8 to 1.

A third evaluation method takes into account the stock removal rate. This is found by dividing the metal removed (10 cubic inches) by the time required to complete the test (three minutes), which equals 3.3 cubic inches per minute.

For maximum efficiency when surface grinding with segments, the full available power of the machine should be used. In fact, it is not uncommon to overload the machine motor as much as 50 per cent during the grinding cycle. Most machines are equipped with red lights or calibrated meters to warn the operator.

The amperes used are directly proportional to the amount of heat generated or the energy employed during grinding. Abrasive engineers in Carborundum's Grinding Laboratory have found that the company's new V-40 grinding segments and ring-wheels remove a large amount of stock with low amperage requirements. These tools have been designed to grind free, with minimum resistance to the abrasive action.

There are many different types of machines suitable for segment and ring-wheel operations. However, most of these machines can be classified in one of three main groups:

1. Traveling head type, usually having a horizontal spindle;
2. Rotating table type with vertical or horizontal spindle;
3. Traveling table type with vertical or horizontal spindle.

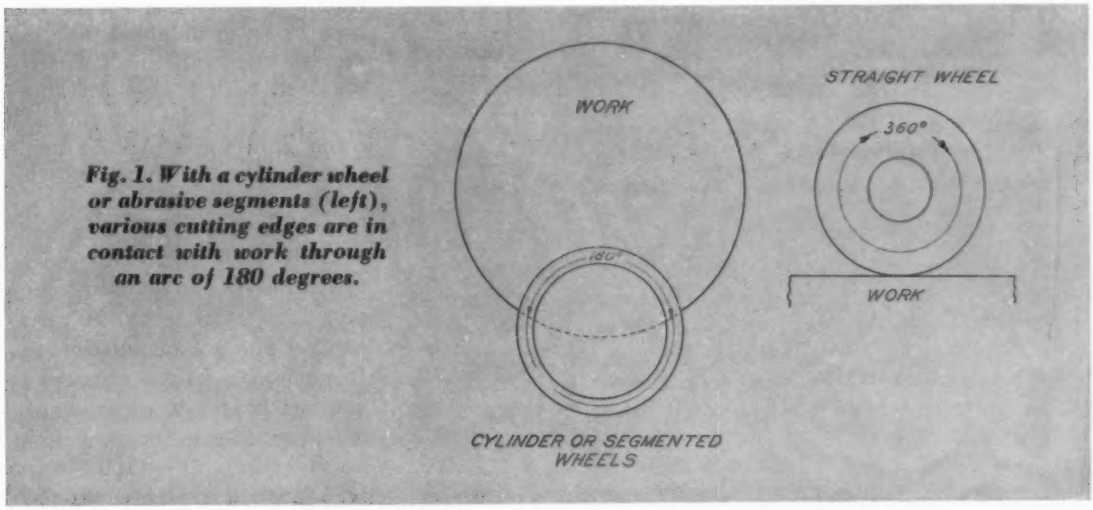


Fig. 1. With a cylinder wheel or abrasive segments (left), various cutting edges are in contact with work through an arc of 180 degrees.

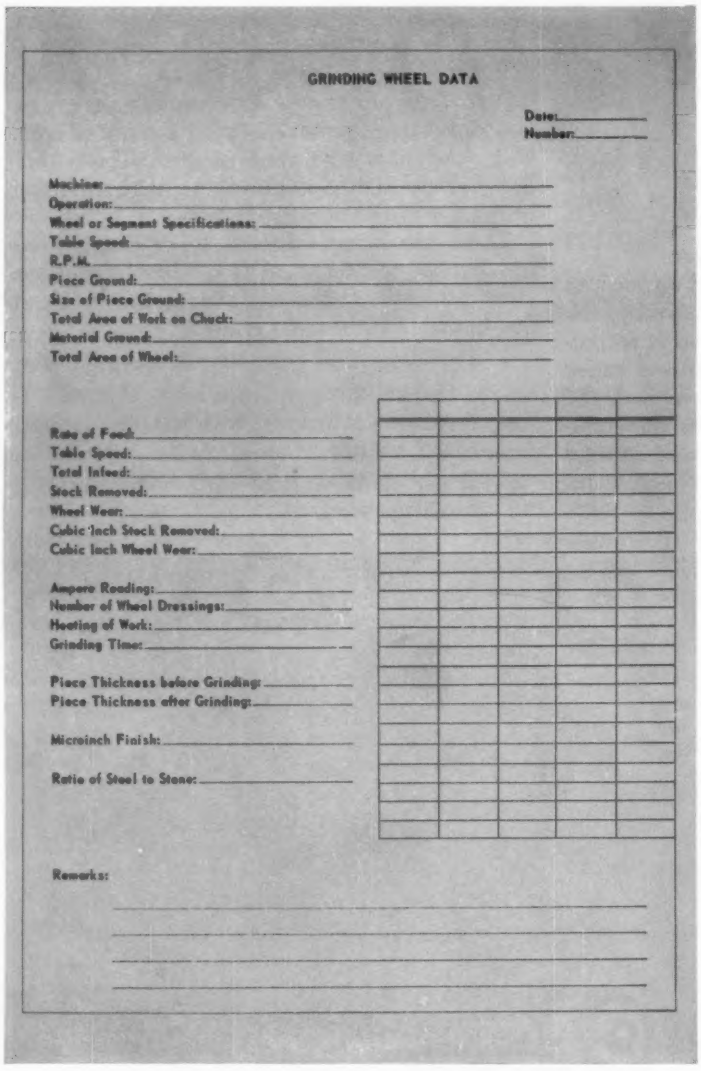
Each machine has certain advantages, depending on the particular application. Traveling head or table machines are generally used to grind long pieces such as shear blades, flat ways, or similar parts that are much longer than they are wide. Rotating table machines, which are limited by the work size, are often used for small parts.

There is a tendency today to build larger machines and increase the horsepower of the motors in order to remove more metal faster. This places a greater load on the machine and abrasive tool, making it necessary to observe certain precautions. Machine maintenance is of special importance. The machine should be checked periodically to make certain that the ways are in good shape, the adjustable gibs are tight, and play and vibration are at a minimum. All moving parts must be well lubricated at all times, and the chuck or mounting device should be replaced when it becomes worn.

Disregard of these factors will increase abrasive costs and, at the same time, affect the finish produced and the accuracy that can be maintained. Parallelism of the grinding surfaces of the ring-wheel or segments with relation to the work is necessary to insure maximum efficiency and the production of flat surfaces.

Cleanliness of the machine is very important, and a definite procedure should be set up to clean the machine at least once a day—including removal of the grinding swarf. Swarf may be removed by the use of filters or baffle plates in the coolant tanks. Dirt or swarf hinders efficient grinding by slowing the cutting action due to loading of the abrasive. A squeegee (such as the type used to clean windows) is useful in removing swarf from the work-pieces and for cleaning the grinding machine table.

As considerable heat is generated in grinding, it is essential that ample coolant be applied. Coolant valves should be kept clean, and pumps, as well as the entire coolant system, should be inspected periodically and properly maintained to insure maximum circulation. The spout should be directed toward the point of grinding whenever possible, or around the grinding area when a large amount of metal is being ground at one time. Sometimes it is advantageous to splash or send a spray of coolant directly on the face of the wheel.



GRINDING WHEEL DATA

Date:
Number:

Machine:
Operation:
Wheel or Segment Specifications:
Table Speed:
R.P.M.
Piece Ground:
Size of Piece Ground:
Total Area of Work on Chuck:
Material Ground:
Total Area of Wheel:

Rate of Feed:
Table Speed:
Total Infeed:
Stock Removed:
Wheel Wear:
Cubic Inch Stock Removed:
Cubic Inch Wheel Wear:

Ampere Reading:
Number of Wheel Dressings:
Heating of Work:
Grinding Time:

Piece Thickness before Grinding:
Piece Thickness after Grinding:

Microinch Finish:

Ratio of Steel to Stone:

Remarks:

The surface finish produced on the work during grinding is not always dependent on the abrasive grain size. In fact, the operation of the grinding machine determines, to a great extent, the type of finish obtained. For example, a smooth finish can be obtained with coarse grit abrasive by loading the segments and using light feeds. Also, a common practice for improving the finish is to increase the spark-out time at the end of the operation.

With such methods, coarse grit abrasives can be used to obtain high stock removal rates, and yet produce smooth finishes. In general, a 24-grit abrasive is satisfactory for a rough finish, a 36- or 46-grit for a medium finish, and an 80- or 100-grit for finer finishes.

Stretching and Drilling Techniques for the Jet Age

By RAY ORTIZ
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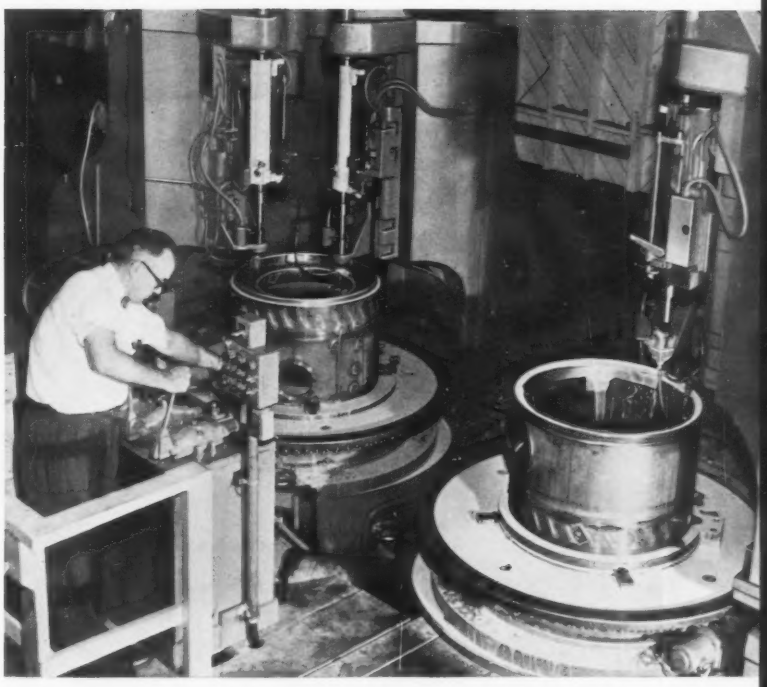


BIG jobs mean big machines. At Ryan Aeronautical Co., where the jobs are not only growing bigger but more complex, new machine tools are assuming increasingly impressive proportions. Not only does their size distinguish them; within their bulk are delicately adjusted mechanisms that permit push-button operations to perform intricate tasks.

Installation of new machines was a common occurrence during the past year—a period of the most intensive tooling buildup in the company's history. Preparations were made for quantity production of such massive units as the aft fuselage sections of the Boeing KC-135 jet tanker-transport and 707 jet Stratoliner and for an accelerated output of jet-engine parts. Typical of the new tools are a Bath radial draw former—the fifth in a battery of five stretch presses—and an Avey automatic special drilling machine.

Metal must be distorted beyond its yield point if it is to be formed, or it will spring back to its original shape. Impact-forming machines, such as stamping presses and air hammers, require tremendous forces to do this because they compress the metal as they force it into shape. Stretch presses, on the other hand, first stretch the metal, holding it under tension where it is in a semiplastic state, then form it. Because the metal is semiplastic, much less force is required.

Most stretch presses operate by pulling the metal with large gripper jaws mounted on a table. While the tension is maintained, a die is rotated against the work, forming the material a fraction of an inch at a time. The principal advantage of the process is that it eliminates spring-back and permits almost perfect forming to contours. Also, matched male and female dies are not necessary.

The radial draw former, Fig. 1, is a refinement of the stretch press principle. Metal is held in controlled tension while a rotating table draws it radially over the outer surfaces of a table-mounted die. At the same time, a wiping shoe applies pressure to confine the metal to the die face and assist with the forming. This shoe, driven by a hydraulic ram, is shaped to mate with the cross-section of the die. Thus, the action wipes the metal into the die, preventing wrinkling and maintaining exact shape and angularity of the part. A large variety of complex curves and shapes can be handled.

Currently, the 40-foot long machine is used for stretch-forming aluminum extrusions, such as bulkhead frames, and attaching members for the KC-135 and 707 components. Later, it will be used for stainless-steel and titanium work as well as for aluminum sections for the Douglas DC-8 jetliner. The rotary table on which parts are stretched is 10 feet in diameter—20 inches larger than any similar machine in the West, when installed.

In radial draw work, three forces are acting on the material: (1) longitudinal tension is exerted, which brings the fibers of the material into the plastic range; (2) radial forming action, gen-

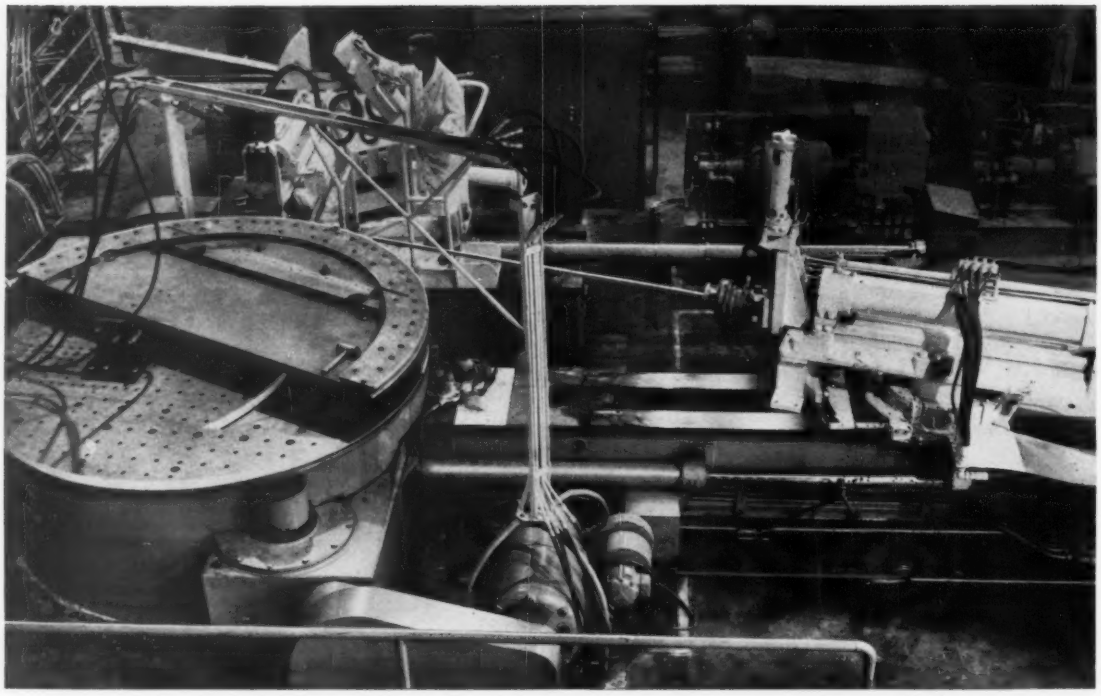


Fig. 1. The curved forming die seen on the edge of the table is rotated against the work, which is under tension between gripper jaws.

erated as the table sweeps the mounted die into the metal to create the contour; and (3) compression is applied by the wiping shoe, to assist with the forming and to obtain the desired cross-section.

Wiping forces can be exerted in a vertical as well as horizontal direction. A wide horizontal flange in the cross-section of an extrusion can be kept flat and at a correct angle to a vertical flange. This reduces or eliminates much bench work and improves mating with other parts in assemblies.

Vertical movements of the wiping shoe can be made during stretch-forming. Rising and falling contours can be combined with curves in the horizontal plane in one piece. Previously, such parts were usually fabricated by joining several pieces. The forming die can rotate through 360 degrees in either direction to form spirals, full wrap-arounds (circular, oval, or rectangular), and parts involving severe hook shapes at one or both ends.

Hydraulic cylinders of the draw former have a maximum pulling capacity of 35 tons, and the ram powering the wiper shoe is rated at 12 tons. The two pumps in the hydraulic system are driven by 30-hp motors. A 40-hp motor drives the rotary table.

To supplement the draw former, plant engineers have installed a large, low-temperature, industrial type refrigerator, Fig. 2. Measuring 25 feet long, 6 feet deep, and 4 feet wide, this box holds work between zero and —10 degrees F. For convenience in handling long parts, the refrigerator has no top, yet the close-temperature limits must be maintained.

Aluminum-alloy parts to be formed are first solution-heat-treated to temperatures above 900 degrees F. This causes the alloying constituents, principally copper, to dissolve in solid solution, leaving the metal soft and malleable. The hot metal is cooled quickly to room temperature, then placed in the refrigerator, which holds the alloy in solid solution.

The metal parts are taken from the refrigerator and formed immediately, then allowed to come up to room temperature. In warming, they quickly regain their strength and hardness, because the alloying ingredients precipitate out of solution and lock the metal crystals. It would be possible to form the parts and then heat-treat them, but such a procedure would create sizable warpage problems.

The new drilling machine, shown in the heading illustration, incorporates two electrically driven tables and four hydraulically powered

spindles. These elements are controlled in an automatic cycle that permits drilling of 352 holes in a Pratt & Whitney Aircraft J-57 jet-engine intermediate case in a fraction of the time formerly required. The operator pushes a button and drills 168 holes in two different flanges. Then he drills 184 more holes in two other flanges after turning over the case. Indexing of the part and feed engagement are automatic.

Cycling is controlled by a mechanical programming wheel, which rotates one-half revolution for each revolution of the index table. One program is established for each table. The assembly makes two complete revolutions: first the outer pattern of holes is drilled, followed by drilling of the inner pattern.

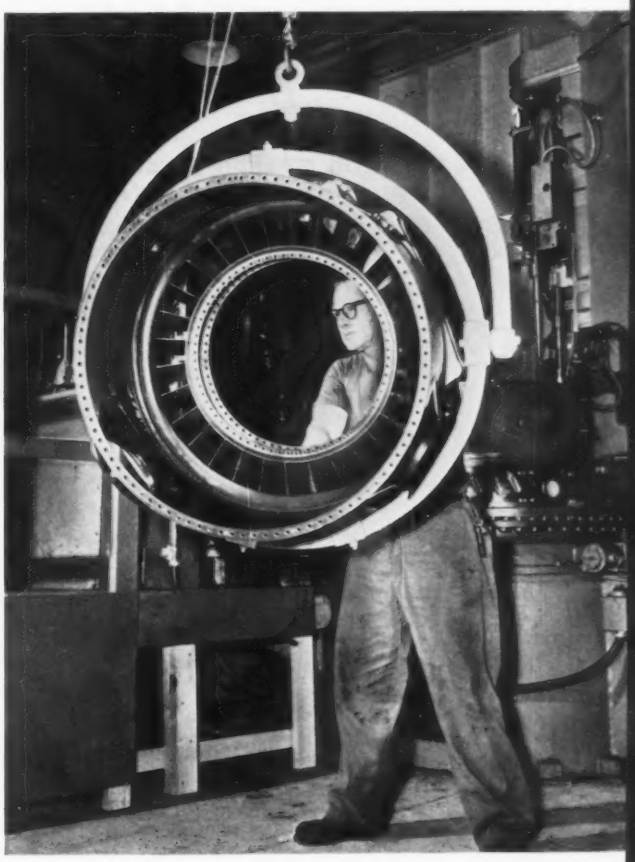
A series of pins are inserted in perforations in the programming wheel and actuate limit switches on rollers that contact the pins as the wheel revolves. These limit switches signal a shot bolt to lock the table in position, and the drill head to advance. (There are four drill heads, two to each table.) The drill descends rapidly to within approximately 1/16 inch of the work, then feeds to depth. A self-contained bushing carrier is located on a power slide which guides the drill into the work. This carrier eliminates the need for a separate drill bushing for each hole in the pattern.

Both tables can be operative simultaneously. While the machine is drilling holes in two flanges in one side of the case, the operator is busy loading the other table, as in Fig. 3. No time is lost.

Hydraulic column locators move in and out on steel ways for loading and unloading work. The locators, operated by a lever, have 20 inches of travel, permitting the drilling of bolt circles from 15 to 55 inches. A remotely operated shot bolt gives the column final positioning. It will repeat to within 0.001-inch accuracy. Various spindle speeds are provided by a quick-change gear-box. A large locating plug in the center of each table permits rapid and convenient interchange of work-holding fixtures.

Fig. 2. Sub-zero temperature in this refrigerated pit keeps the heat-treated metal soft and malleable until stretch-formed.

Fig. 3. While an intermediate case on one table is being drilled, the operator unloads a completed case from the other table.



BILLIONS of Fasteners Each Year

In an effort to satisfy industry's ever-increasing demand for fasteners, Parker-Kalon has expanded its production volume by acquiring a modern plant. This article describes how these new facilities are being utilized.

By HAROLD W. BREDIN
Assistant Editor

BILLIONS of fasteners in thousands of types and sizes are being produced annually by the Parker-Kalon Division of the General American Transportation Co. The division, a direct outgrowth of a company founded by the inventor of the self-tapping screw, is now newly acclimated in a modern plant at Clifton, N. J.

While sheet metal screws in their numerous standard and special forms are still the company's major product, the equipment and technical skill acquired over the years have led to the development of a substantial line of fasteners. Socket cap- and set-screws, thumb screws, wing-nuts, screw nails, and masonry nails all appear on the company's production schedules.

Initial operations on nearly all Parker-Kalon fasteners are performed in the cold-heading department. Here, a large battery of automatic machines are used to turn out a constant flow of headed blanks.

Wire is the life blood of the plant. It is supplied to the headers in coils which are then loaded on reels. Each header is served by a single reel. Within the department, the coils are handled by a single operator who maneuvers a number of traveling hoists over a system of monorails. From a central control station, this man can position a coil of wire directly above the reel at any header in the section. When a mechanic sets up a machine for operation, he simply lowers the coil onto

the reel by means of a control box suspended from the individual hoist.

A considerable inventory of wire is necessitated by the inherently high production of the plant. Wire in various grades of steel, stainless steel, brass, and aluminum must be stocked. Copper-coated steel is often used, the copper serving as a lubricant between the heading die and the wire.

From the reel, the wire is fed to a machine such as the Waterbury Farrel toggle action header shown in Fig. 1. This double-stroke machine has a 1/4-inch diameter wire capacity and is set up to head blanks at the rate of more than 100 per minute. These particular blanks are for 0.246-inch nominal diameter, 14-thread, 1 1/2-inch self-tapping screws with a combination washer-hexagon type head.

Prior to entering the feed mechanism of the machine, the wire is straightened by passing through a series of externally mounted rollers. Once in the machine, the wire is fed to a stop. Then, a shear blade not only cuts the piece to the required size but also transfers it to the die. Heading is accomplished with two strokes of the machine. Production rates range from fifty strokes per minute for machines handling the larger diameter wire to about 400 strokes per minute with the so-called, high-speed headers. Blanks for the larger socket-head cap-screws—up to 1 1/2 inches in nominal diameter—are hot-headed.

After heading, the work-pieces are carried to all subsequent operations in tote boxes. A combination belt and roller conveyor system is used to move these boxes from department to department within the plant.

The multiplicity of fasteners produced do not all require the same operations, nor do they require the same sequence of operations. Proper routing of the work-pieces is facilitated by a number of transfer stations. The main transfer table is illustrated in Fig. 2. Here, the tote boxes are received and sent to their proper destination in accordance with routing tags accompanying each batch.

Headed blanks which require further forming are sent to the heat-treating section for annealing. This process prevents cracking or fracturing of the piece during the additional cold-working.

Blanks for sheet metal screws and other fasteners are pointed on presses modified to the specifications of the company. Such a machine is illustrated in Fig. 3. In this instance, the feed hopper is manually loaded with round-head blanks for No. 14 self-tapping screws. From the hopper, work-pieces are automatically fed to an indexing wheel which, in turn, transports the blanks to the die—all at the rate of 175 per minute.

The pointing operation is a combination of swaging and cutting. Punch and die cavities are identical in shape, each having the form of half the screw point. The edges of these cavities are beveled so that they can cut off the metal not confined within the die opening when the press ram is fully descended. Careful tool adjustment

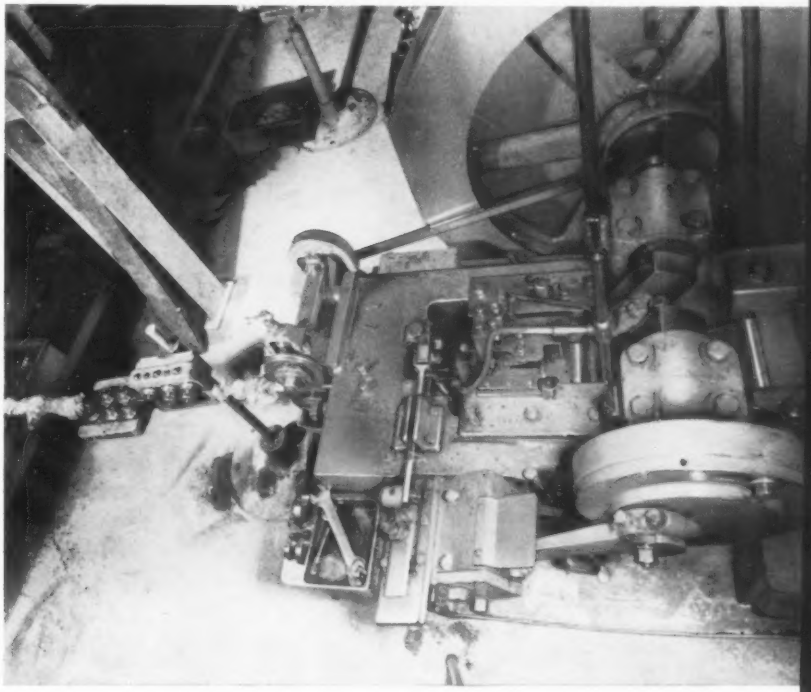


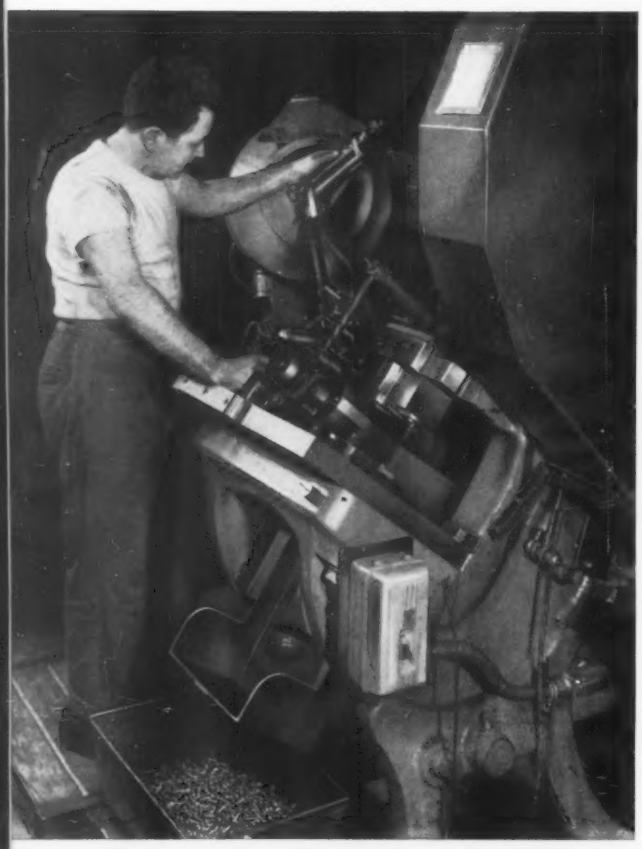
Fig. 1. Overhead view of a cold-heading machine. Rollers at the left straighten the wire as it unrolls from a reel (not shown).

Fig. 2. Main transfer station for the conveyor system. Here, routing of fasteners to the next operation is easily controlled.

minimizes the forming of seams along the line where the knife-like edges of the punch and die come together.

Many fasteners, including special drive screws, require slotting. A large group of high-speed slotters with rotary saws perform all such operations at the plant. As with the pointers, these machines are automatically fed from hoppers.

Prior to thread-rolling, the points of some types of fasteners are shaved to meet customer specifications. The machines used for this operation are also fed automatically from manually loaded hoppers. Here, however, the feed mechanism is particularly interesting, since it can be set to turn either end of screw to the shaving tools.



Threaded surfaces on the majority of fasteners produced at the plant are formed by rolling. In this final cold-working operation, the blank is rolled between two dies—one stationary and the other moving. The working face of each die is serrated with parallel grooves that have the size and form of the desired thread. The angle between the serrations and the axis of the blank determines the lead of the helix. In shaping the thread, the dies both raise and depress metal from the periphery of the blank. This cold-working results in an unusually strong thread.

A typical thread-rolling operation is illustrated in Fig. 4. Oval-head blanks for sheet metal screws are shown being manually loaded into the automatic feed hopper of a Waterbury Farrel thread roller. Immediately after passing from this hopper, these screws enter a device which mechanically inserts each into an external-toothed washer. The assembly is then fed to a set of flat type dies for rolling. The machine is seen with its reciprocating ram fully extended to expose the moving die.

The washers used in this operation are made of copper-coated steel to prevent them from becoming case-hardened when the assembly is placed in the carburizing bath.

Not all fasteners produced at the company are

Fig. 3. Blanks are automatically fed to the dies for pointing. The metal is both cut and formed in this operation.

threaded by rolling. The threads for some are cut in automatic machines. Other headless type screws are ground from the solid in a centerless thread-grinding machine such as the one seen in Fig. 5, made by Landis Machine Co. Operating much as the conventional centerless grinder, this machine has a grinding wheel, a regulating wheel, and a work-rest. Threads are form-ground by annular grooves on the periphery of the abrasive wheel, which is tilted at the angle of the desired helix.

The machine shown is set up to grind threads into hardened blanks for 1-inch long socket set-screws (3/4-10 thread). Work-pieces are automatically fed from a vibrating hopper to the grinding wheel. Completed screws can be seen leaving the machine. Metallic particles are cleaned from the oil coolant by passing it over a magnetic drum.

The thread form produced by the grinding wheel is regularly checked on an optical comparator. A crush type wheel dressing tool is an integral part of each centerless grinding machine.

Wing-nuts are necessarily handled a little differently than most fasteners produced at the plant. Five steps in making a wing-nut are illustrated in Fig. 6. Short, rod-like blanks with a ball at the center are formed from wire in the cold-heading department. After annealing, these blanks are returned to a cold-heading machine for reheading. There, the wings are bent and the ball is headed into a truncated cone. On the larger-size wing-nuts, this operation is performed on a press.

Next, the wings are flattened using dies of the type shown in Fig. 6. A proper-size hole is then punched through the nut in preparation for threading. The nuts are tapped, three at a time, in a multiple-spindle machine. Following the threading, all fasteners are washed with a heated detergent in a parts cleaning machine made by the Metalwash Machine Co.

Self-tapping screws must have a hard surface to thread their way through the metal but must also be ductile enough at the core to withstand loading. Standard sheet metal screws are case-hardened to about 60 Rockwell C at the surface. This is accomplished by carburizing in one of a group of kerosene-fired furnaces, Fig. 7, developed by the company especially for this purpose.

Fasteners are hand-loaded, by scoop, into a wire basket that is mounted within the furnace on a swinging yoke. The basket is then lowered

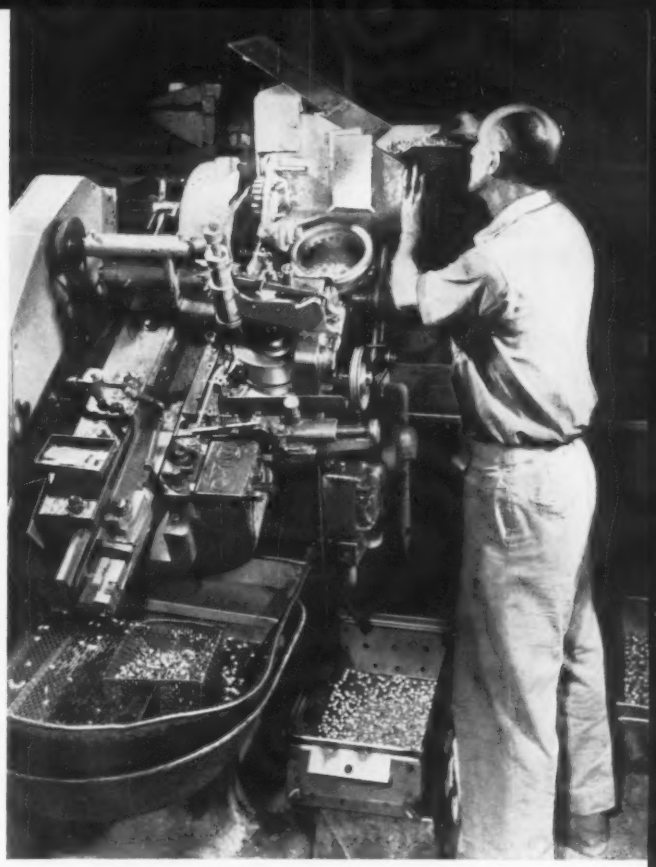


Fig. 4. This thread-rolling machine is equipped to first automatically assemble the screws with washers. The rolling (which raises the thread) prevents loss of the washers.

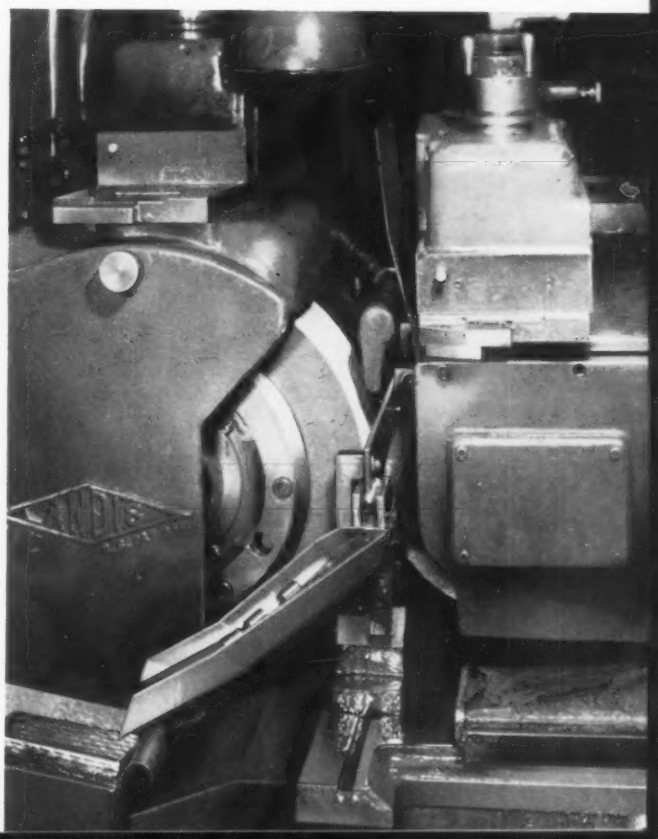


Fig. 5. Threads on headless fasteners are form-ground from solid blanks in this centerless thread-grinding machine.

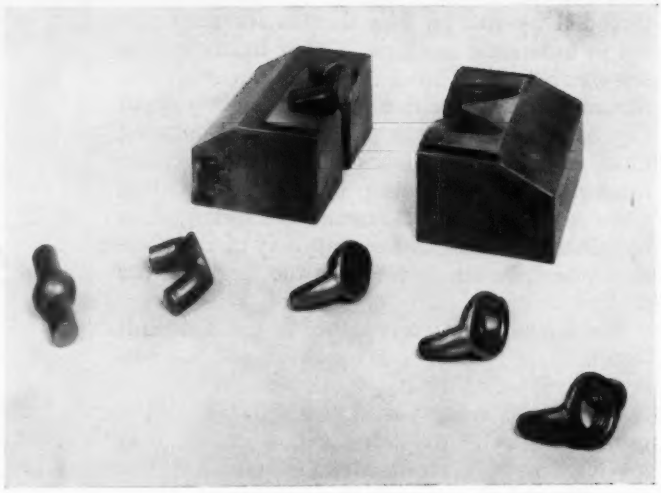


Fig. 6. Wing-nuts are produced from wire in a series of three cold-forming operations. Holes are then punched through and tapped. Dies shown are used to flatten the wings.

into a 1600-degree F. bath of molten cyanide salts by means of a conveniently positioned handwheel. Soaking periods range from seven to forty minutes.

Following this treatment, the operator raises the basket from the bath and hardens the screws by dumping them into a water-quenching tank located below the furnace. Work-pieces are removed from this tank through a revolving conveyor tube that is equipped with an internal helical vane.

In order to prevent spattering, screws must be thoroughly dry before entering the furnace. As a safety measure, the operator is protected by a plastic face guard. Sheet metal screws made of the heat-treatable stainless steel grades are hardened with neutral salts in a furnace similar to the type used for carburizing.

Fasteners such as cap-screws are through-hardened in the Westinghouse hardening and tempering furnace illustrated in Fig. 8. The work-pieces are automatically conveyed through the controlled inert atmosphere of the furnace for periods ranging from ten to forty minutes. The time required depends largely on the size of screws. Temperature within the furnace is maintained at 1500 degrees F.

After passing through the furnace proper, the

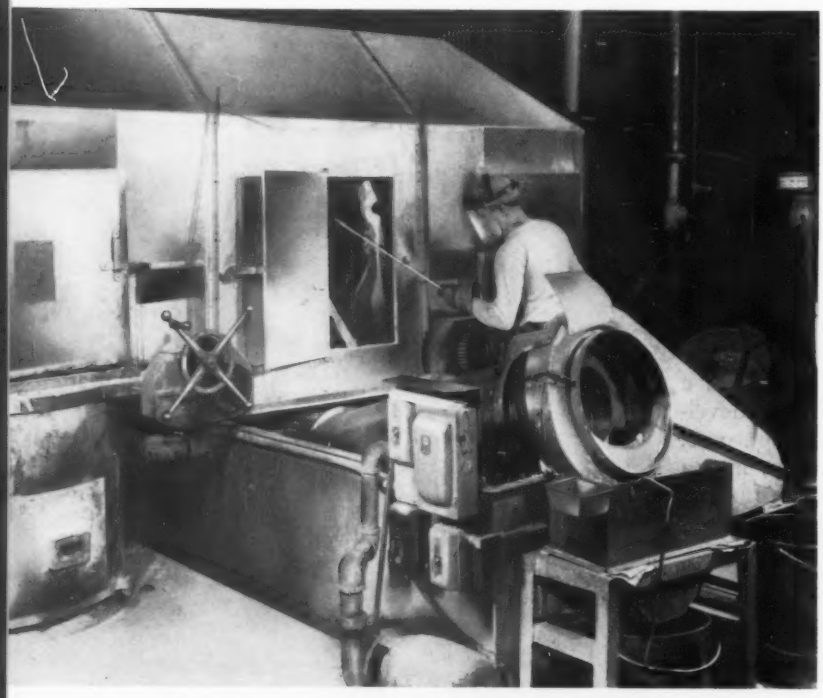


Fig. 7. After soaking in molten cyanide salts, fasteners are case-hardened by quenching them in a water tank below the furnace. Conveyor tube in foreground removes screws from the tank.

screws are quenched in an oil bath. A metal-link type conveyor removes the hardened pieces from the quenching tank and delivers them to the tempering oven. Another adjustable speed conveyor carries the fasteners through the tempering chamber at rates of twenty minutes to one and one-half hours. Oven temperatures can be held constant at between 300 and 1000 degrees F. Coolant is sprayed on the screws as they emerge from the oven chamber.

Although fasteners are plated only on special order, a large department must be maintained for this purpose. Cadmium, nickel, brass, zinc, and statuary bronze are popular plating metals. After washing and pickling, the screws are electroplated while being rotated in barrels immersed in the required electrolyte. A typical barrel-plating operation consists of depositing a 0.00015-inch coating of zinc on a batch of sheet metal screws in an hour, at 15 volts, with a current of 300 amperes. Many fasteners are given a blue-oxide finish in this department. This treatment is also considered as a rust preventive measure.

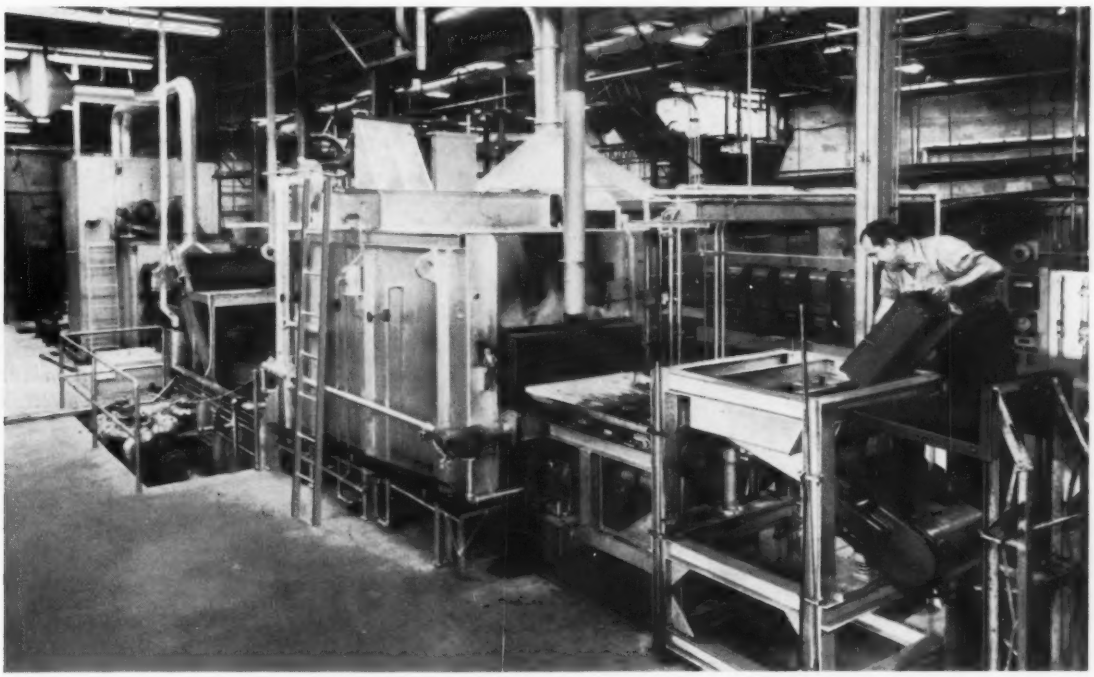
Plated fasteners are subject to a condition known as hydrogen embrittlement. The metal becomes brittle, and, in the case of screws, tightening often causes the heads to snap off. Cadmium and zinc plating are the main causes of this type damage.

To prevent such breakage, plated fasteners are heat-treated in a degassing furnace. This furnace is designed to remove the hydrogen from the work-pieces. A high-temperature treatment of short duration could be applied, but such a process would detrimentally affect the hardness already imparted to the fastener. The relatively low temperature that can safely be used requires a much longer time to effect the same amount of hydrogen removal. The Lanly degassing furnace shown in the heading illustration is used to process these screws at 350 degrees F. for a period of three hours. A conveyor belt carries the plated fasteners through the long furnace with a continuous movement.

A large tooling department makes Parker-Kalon almost self-sufficient in this category. Heading dies, pointing dies, thread-rolling dies, and other short-life equipment are all made on a production basis. Here, heading dies are made by pressing a hub in the shape of the required screw-head into a die blank of soft tool steel which is then hardened to approximately 68 Rockwell C.

The grooves in thread-rolling dies are milled or hobbed into soft blanks before hardening or ground into hardened blanks. A certain minimum inventory based on years of tooling experience must be maintained to avoid any interruption to production.

Fig. 8. Screws are loaded on conveyor for passage through hardening furnace. After an oil quench, the parts are automatically sent through the tempering oven (left).



Preventing Machine Damage with Electric Clutches and Brakes

By W. E. TIMMCKE
Manager of Engineering, Industrial Division
Warner Electric Brake & Clutch Co.
Beloit, Wis.

WITH machines operating at higher speeds and performing more functions automatically, it becomes increasingly important to provide adequate protection against incorrect cycling, other errors, or machine damage. On machines equipped with electric motion control, it is easy to wire the controls so that the machine will not be damaged in the event of improper operation. Many machinery builders have worked with Warner Electric Brake & Clutch Co., Beloit, Wis., to equip their machines with clutches, brakes, and combination clutch-brakes which perform a safety function in addition to transmitting power.

One such manufacturer is the Ferguson Machine & Tool Co., St. Louis, Mo., producer of rotary transfer machines for automatic assembly. This company makes the Intermittor, Fig. 1, a high-speed, precision table capable of as many as 30,000 indexes per hour. A standard power assembly for the Intermittor, called Vari-Dwell, includes a motor, Warner clutch-brake unit, and speed reducer.

Due to instantaneous actuation and disengagement, the clutch-brake unit synchronizes the action of the tooling with the intermittent motion of the index-table. Also, it permits control of dwell time while maintaining minimum transfer time. The safety features made possible by the clutch-brake are also important. For example, when electric interlocks are used, the tools and dial can be stopped if the movements fail to synchronize. An electrical malfunction detection system can be used to reverse the clutch-brake action in the case of automatic emergency stops. Manual emergency stops will halt the rotation of the dial and tooling movement by reversing the actuation of the clutch-brake. Also, output torque can be regulated by rheostat control of the clutch to prevent tool damage in case of a jam.

Another machine equipped with a Warner clutch-brake is the Ringmaster, an automatic assembly machine which places rings on automotive pistons. Made by the Douglas Tool Co., Hazel Park, Mich., this machine uses an electric clutch-brake to index the work-table and to pro-

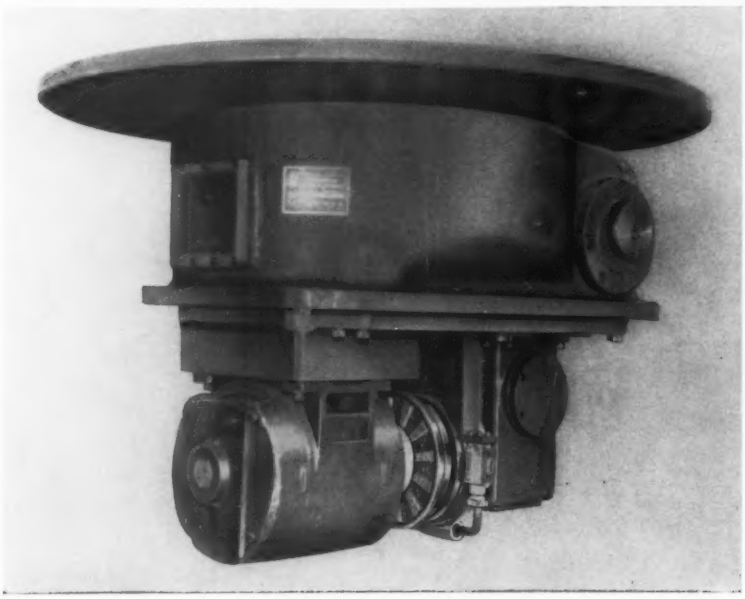


Fig. 1. High-speed index-table with standard power assembly mounted beneath it. Magnetic clutch-brake can be seen between motor at left and gear-reduction unit at right.

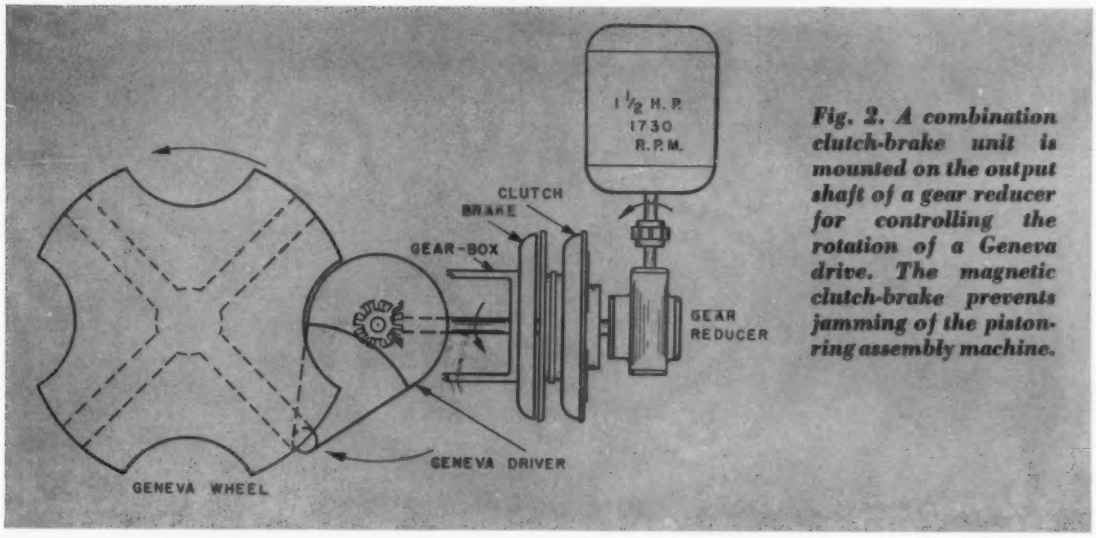


Fig. 2. A combination clutch-brake unit is mounted on the output shaft of a gear reducer for controlling the rotation of a Geneva drive. The magnetic clutch-brake prevents jamming of the piston-ring assembly machine.

vide a means of electrically interlocking the cycle to prevent jamming.

Limit switches actuate the clutch-brake if there is any tendency for the work to jam, disengaging the power clutch and engaging the brake to stop the machine instantly before any damage can result. The machine features a continuous magazine feed and a fully automatic cycle. A total of 1800 piston-and-ring assemblies can be produced per hour at only 80 per cent efficiency.

The clutch-brake is located on the output shaft of a speed reducer, as seen in Fig. 2, to control the rotation of a Geneva drive. Push-button control permits fast, economical machine setup. It is estimated that production per man has increased 1000 per cent since the change-over to Warner units. It is now possible to "inch" the machine when setting it up without danger of jamming.

A different safety function is performed by a Warner brake used on a double-spindle grinding machine built by the Gardner Machine Co., Beloit, Wis. This machine has been designed primarily to grind two opposed parallel surfaces in one operation. It also may be used to grind a single surface of two opposed parts.

As seen in Fig. 3, the brake on this machine stops the dresser bar drive at the end of the return stroke, so that the dresser will not continue in motion and damage the machine. Accuracy of the grinding machine depends greatly on the proper function of the dressing attachment. The dresser is essentially a rigid bracket bolted to the hood of the machine and arranged to propel a heavy bar and its cutters between, and parallel to, the faces of the wheels. Angularity and rigidity of the bar are essential for flat dressing.

The brake, attached to the dresser, is energized by a normally open limit switch actuated by a dog when the dresser bar returns to rest position. In operation, the "dresser in" button is depressed and the motor starts driving the bar toward the center of the wheel. At the farthest point of travel, a dog engages a limit switch which reverses the motor. At the highest point of travel, a dog engages another limit switch to de-energize the motor and energize the brake.

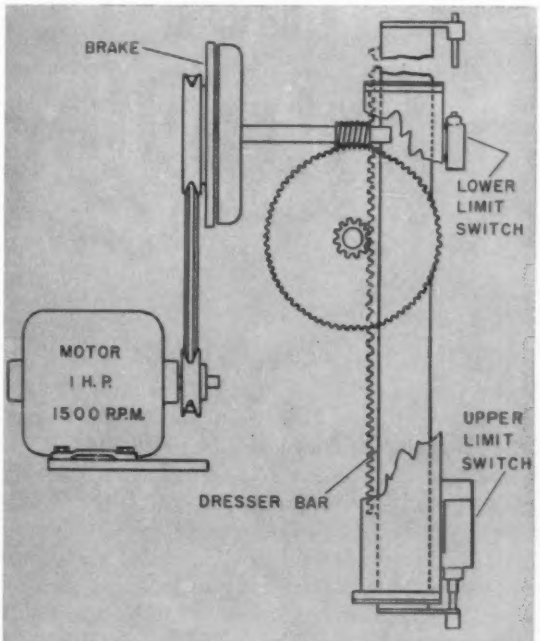


Fig. 3. This arrangement of a magnetic brake and limit switches controls the travel of the dresser bar on a double-spindle grinding machine.

Latest Techniques in Extruding Aluminum

By CHARLES H. WICK
Managing Editor

IN the first installment of this article, published in the May, 1957, number of MACHINERY, methods employed at Kaiser Aluminum & Chemical Corporation's Halethorpe, Md., plant for casting ingots, extruding on huge 8000-ton presses, and ultrasonically inspecting the extrusions were described. This second and concluding installment deals with the extrusion of aluminum on self-contained, 2750-ton presses.

Output of Kaiser Aluminum's Light Press Plant at Halethorpe is being doubled by the addition of four Birdsboro extrusion presses and auxiliary equipment. Three of the horizontal, four-column presses are rated at 2750-ton capacity and are capable of extruding billets from 8 to 12 inches in diameter and up to 32 inches in length. The fourth Birdsboro press will be a 3500-ton, water-hydraulic, tube extruding press.

The 2750-ton oil-hydraulic machines, two of which can be seen in the heading illustration, are self-contained and have several unique features designed to increase production and hold costs to a minimum. For example, a transverse die slide is provided to permit inserting a die stack in either of two locations. While extrusion is being performed through one die, a second die set can be inserted, removed, or dressed, as seen in Fig. 8. This arrangement saves from ten to fifteen minutes per die change.

A long stroke arrangement gives the advantage of reducing the dead cycle time (the time when not actually extruding) to about twenty seconds,

compared to as much as one minute on older presses. Also, the presses are adaptable to the extrusion of wide shapes from a rectangular billet container having an opening 4 inches high by 16 inches wide.

The hydraulic system on each press, Fig. 9, contains three large Oilgear rotary piston pumps of the radial type. Two of the pumps are of the constant-delivery type, providing 108 gallons per minute, and the other is an electronically controlled, variable-delivery pump with a capacity of 108 gallons per minute. A 350-hp, double-ended motor drives two of the pumps, and a 200-hp motor drives the variable-delivery pump. A smaller pump, rated at 4.7 gallons per minute, is provided to seal the container at a constant pressure of 3000 psi.

Delivery from the Oilgear DY variable-output pump is controlled by either of two methods. The quantity of oil required for any of the auxiliary motions of the press is recorded on one of six potentiometer-controlled circuits. During a particular operation, the appropriate potentiometer circuit is automatically selected. Output of the variable-delivery pump, corresponding to the setting of any circuit, can be varied from zero to full volume, depending on the speed required for the particular operation. The pump has an electric-hydraulic servo control for moving the slide-block to vary the delivery. The control, connected to the potentiometer circuits, consists of a magnetic amplifier, a hydraulic amplifier, and an electric servo motor.

The second method for controlling delivery from the pumps is to vary the ram speed during extrusion by selector switch and hand lever located on the main control pulpit, Fig. 10. The operator can obtain any pressure range required by selecting just the variable-delivery pump, the variable-delivery pump plus one constant-delivery pump, or all three pumps. With this arrangement, three infinitely variable-delivery ranges are available, 0 to 108, 108 to 216, and 216 to 324 gallons per minute.

Push-buttons, selector switches, and other controls are centrally located on the pulpit to permit automatic, manual, or jogging operation of all press motions. These motions include advancing and returning the main ram, positioning and retracting the billet loader, stripping and sealing the container, raising and lowering the shear blade, and shifting the die slide. A tachometer on the pulpit shows the speed of extrusion, and a dial indicator reveals the total pressure on the ram, which has an area of 1998.3 square inches. Emergency stop buttons are located on the pulpit and at the platen end of the press so that the operator can conveniently halt any motion instantaneously.

To perform a completely automatic extrusion cycle, it is only necessary for the operator to initiate the action by depressing one button. A preheated aluminum-alloy billet that has attained a temperature of about 900 degrees F. is automatically ejected from either of two Magnethermic induction heaters, Fig. 11, provided

Fig. 8. Here, a preheated die is being placed in one station of a hydraulically operated, transverse slide. Meanwhile, extrusion is being performed through die at other station.

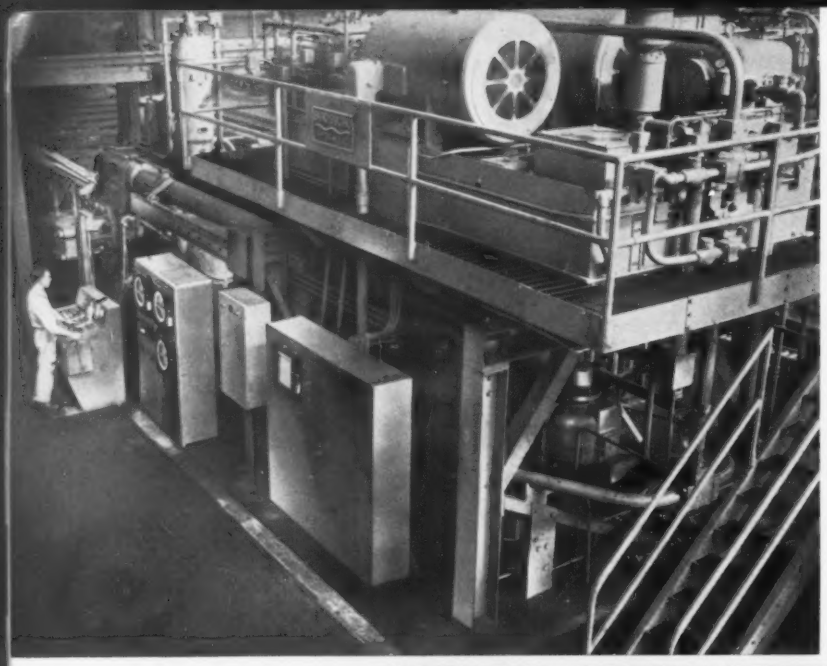


Fig. 9. (Left) Over-all view of a self-contained, oil-hydraulic extrusion press rated at 2750 tons. Two motors drive three pumps, one pump being of the variable-delivery type.

Fig. 10. (Right) Control pulpit of 2750-ton extrusion press contains selector switches, push-buttons, and similar controls to permit automatic, manual, or jogging operation.

alongside each press. The low-frequency billet heaters are rated at 645 kw and operate on 2300-volt, 60-cycle current. Each heater has a capacity of 5000 pounds of billets per hour, requiring from three to four minutes to heat the first billet from room temperature, and from one-half to one minute for subsequent billets which have been preheated.

Power and gravity feed roll conveyors carry the heated billet to a transverse, swinging type loader that automatically positions it at the container entrance, Fig. 12, in a single, cross-the-press motion. As the ram advances and pushes the billet into the container, a hinged lower jaw on the hydraulic loader collapses, and the loader retracts without interfering with rapid closing of the press. The ram can be advanced at rates up to 626 inches per minute and rapidly returned at a maximum speed of 515 inches per minute. Ram speed during extrusion can be varied up to 37 1/2 inches per minute, depending on the material being extruded.

Thermostatically controlled, electrical resistance heating elements are built into the container holder to maintain the billet at extruding temperature. The position of the container can be ad-

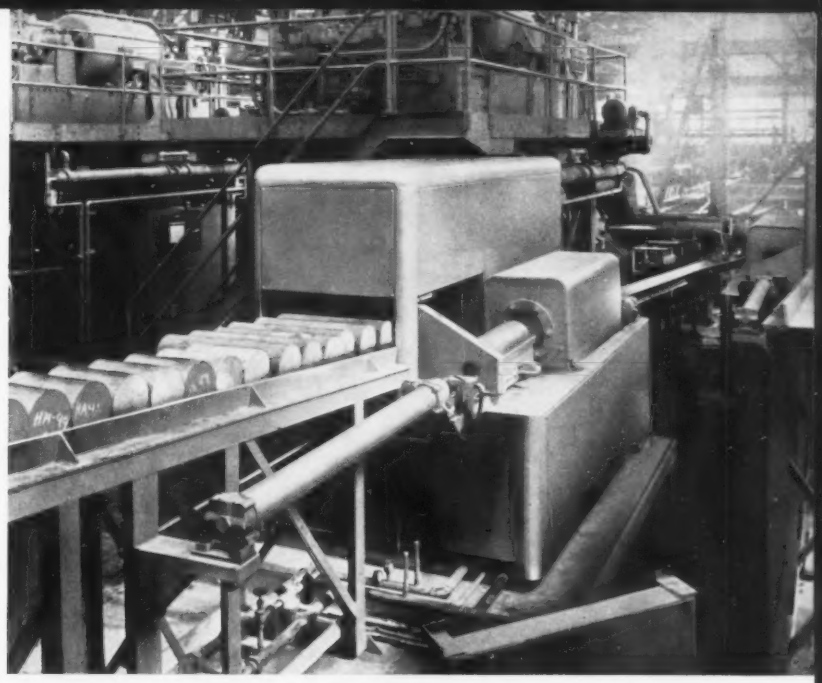


Fig. 11. (Right) Aluminum-alloy billets are heated to a temperature of 900 degrees F. in low-frequency induction units having a capacity of 5000 pounds per hour.

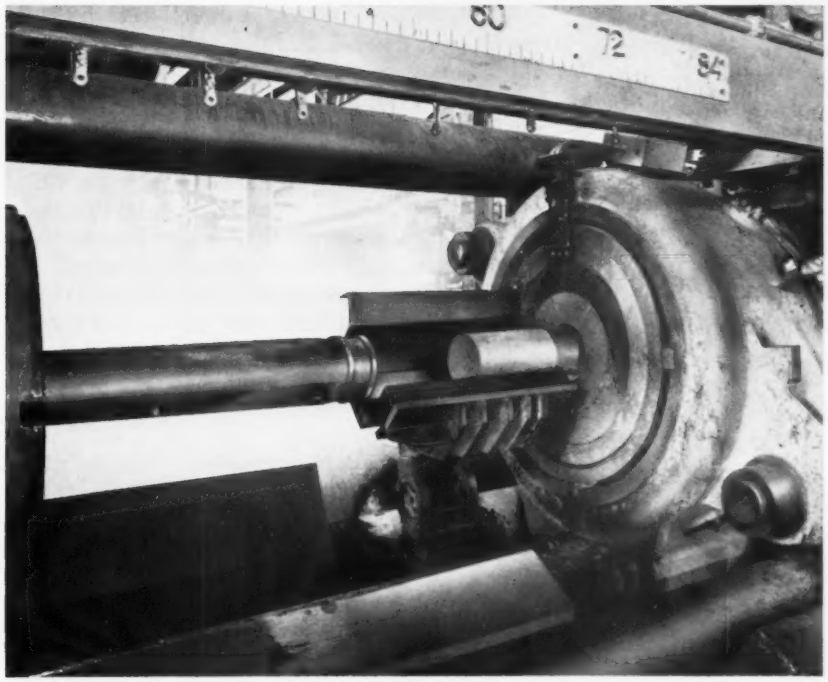


Fig. 12. (Left) Hydraulically operated, swinging type loader automatically positions heated billet between ram and container. Hinged jaw on loader collapses for clearance.

justed vertically and horizontally on ways. Two double-acting hydraulic cylinders mounted in the press platen move the container and seal it against the die face to prevent the escape of metal during extrusion. During sealing, the container can travel at speeds up to 515 inches per minute, and during stripping, speeds of 410 inches per minute are possible.

The entire platen assembly is supported by adjustable bronze shoes on inclined ways, the angular surfaces of which if extended would intersect at the center line of the press. Horizontal platen adjustment is also provided. This arrangement permits accurate alignment of the press members and longitudinal expansion of the tie-rods under tension.

The 1- to 2-inch wide butt, or discard end of the billet, is removed from the extrusion by a hydraulically operated, vertical shear, Fig. 13. First, the container is retracted, then the ram, before the shear is lowered at the rate of 760 inches per minute. The hydraulic cylinder for shifting the die slide can also be used in conjunction with an auxiliary shear to help eject a non-extrudable billet.

Extrusions emerge onto a stationary runout

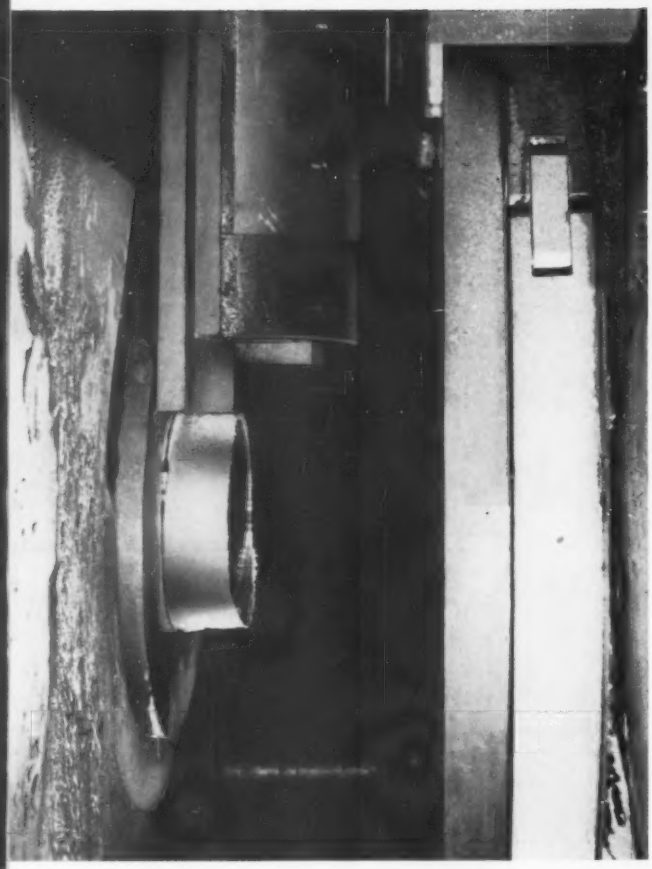


Fig. 13. A 1- to 2-inch thick discard end of the extruded billet is removed by a hydraulically operated, vertical-acting shear operating against the die face.

table, 75 feet long, that is lined with graphite blocks to prevent damaging the surface finish of the aluminum shape. The extrusions are straightened, when required, on the Birdsboro 35-ton hydraulic stretcher seen in Fig. 14. The hydraulically operated headstock gripping head, which travels at speeds infinitely variable from 0 to 93 inches per minute during the 60-inch stretching stroke, is mounted on the right-hand end of the welded steel bed. Take-up of this head in the stretching direction is at the rate of 397 inches per minute, and rapid return is accomplished at 310 inches per minute.

The tailstock gripping head (left) can be positioned in any of a series of clamping holes spaced 12 inches apart along the bed length, so that extrusions from 6 to 95 feet in length can be stretched. Vertically adjustable hardwood benches are provided along the bed to support the extrusions during stretching. Maximum vertical opening of the 14-inch wide jaws is 10 inches. A manually controlled pressure instrument is provided at the control station for limiting the exerted pull of the stretcher. Also, an electrically operated indicator limits the amount of stretch applied to a pre-set value. These two instruments limit the pull.

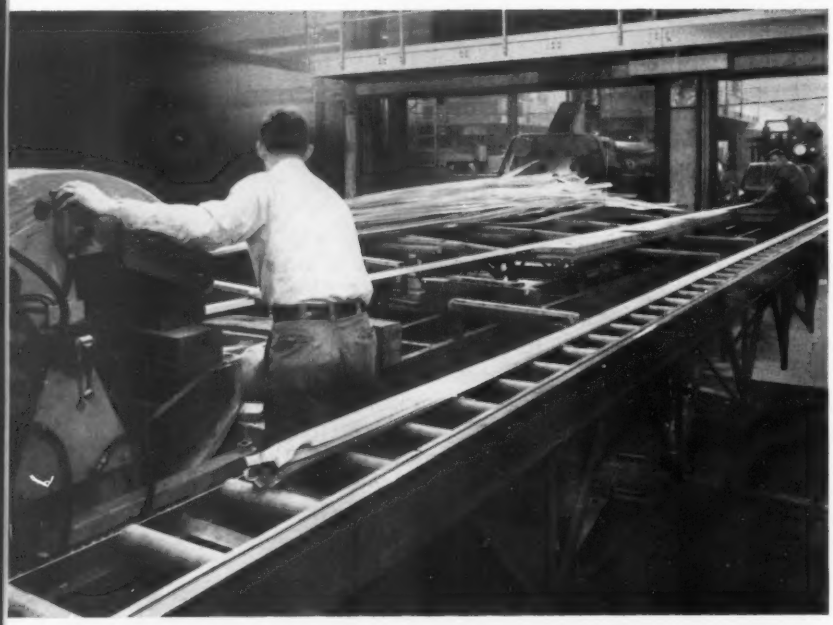


Fig. 14. Extrusions from 6 to 95 feet long are straightened on this 35-ton stretching machine. Movement of the headstock is infinitely variable from 0 to 93 inches per minute during stroke.

MATERIALS

The properties and new applications of materials used in the mechanical industries

High-Strength, Air-Hardening Steel for High-Temperature Applications

A 5 per cent chromium air-hardening steel with high structural strength at both room and elevated temperatures has been announced by Vanadium-Alloys Steel Co., Latrobe, Pa. Known as "VascoJet 1000," it can be heat-treated to tensile strengths of 250,000 to 300,000 psi. It has good notch toughness, a good fatigue life, and is free from residual stress. The high-strength properties are retained up to a temperature of 1000 degrees F.

VascoJet 1000 is said to have a greater strength-to-weight ratio than all other materials, including titanium and precipitation hardening stainless alloys. The material can be fully hardened in the heaviest sections with minimum distortion by air cooling from 1850 degrees F. Parts requiring maximum corrosion and oxidation resistance can be hot-dip aluminized prior to hardening. Where maximum wear resistance is required, parts can be nitrided.

The nominal composition of the steel, in per cent, is given as follows: carbon, 0.40; silicon, 0.90; manganese, 0.30; sulphur, 0.03 max.; phosphorus, 0.03 max.; chromium, 5.00; molybdenum, 1.30; vanadium, 0.50; and iron, the balance. Applications include landing-gear components, engine mounts, air frames, and skins for aircraft and lightweight railroad cars, airborne equipment, truck parts, and high-speed rotors in other industries.

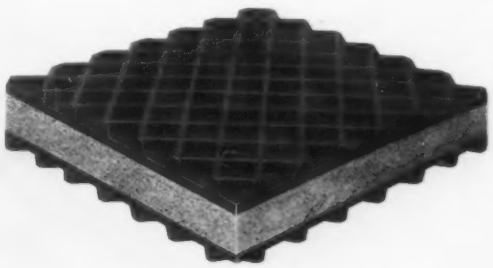
Zinc-Clad Aluminum Sheet Facilitates Soldering of Heat Exchangers

A zinc-clad aluminum alloy has been developed by the Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., for use in the soldering of heat-exchanger equipment. This product, called "Alcoa Soldering Sheet," is said to bring aluminum within range of the ease of solderability heretofore enjoyed by copper. Used with specially developed Alcoa soldering techniques, this clad aluminum is expected to simplify normal maintenance and repair problems of soldered assemblies. It is particularly useful in the automobile radiator field. This aluminum sheet is available in coils or flats and may be obtained clad on one or both sides.

Non-Slip Machinery Mounting Material with Waffle-Grip Embossed Surfaces

A waffle-grip, pad type machinery mounting material, providing a non-slip cushion under which no dirt or machine cuttings will accumulate, has been announced by the Korfund Co., Inc., 48-39M 32nd Place, Long Island City 1, New York. Designated "Waffle-Grip" Elasto-Rib, the padding consists of a 1/2-inch layer of resilient cork permanently bonded between two 1/4-inch layers of oil-resistant neoprene, embossed with a waffle type pattern.

Two types of mounting material are available, the standard-capacity type for loads up to 60 pounds per square inch and the high-capacity type for loads up to 120 pounds per square inch. Both types are available in standard 24- by 36-inch sheets which can be readily cut with a knife. The materials have good vibration-, shock-, and noise-absorbing qualities which make them usable for all types of commercial and industrial machinery.



This waffle-grip, pad type machinery mounting material, composed of two 1/4-inch layers of neoprene separated by a 1/2-inch layer of cork, exhibits good vibration-, shock-, and noise-absorbing qualities.

Free-Machining Steel with Good Finishing Properties

A tool steel that combines free machinability with good finish has been made available by Allegheny Ludlum Steel Corporation, Henry W. Oliver Building, Pittsburgh 22, Pa. The steel, called "Oilgraph-EZ," has the following nominal composition, given in per cent: carbon, 1.45; manganese, 0.80; silicon, 1.15; chromium, 0.20; molybdenum, 0.25; sulphur, 0.10; graphite, 0.30; and iron, the balance.

The combination of the sulphur and graphite makes the steel unusually easy to machine—as if there were a 0.50 to 0.70 per cent graphite content. The graphite particles which are dispersed evenly throughout the steel serve to increase the resistance to wear and galling in service. The addition of sulphur does not adversely affect the other properties of the steel. Applications include drill jig bushings of small diameter, carbon steel taps, gages, punches, numerous dies, and many other machine tool parts. It is available in the form of bars and bar stock.

Solvent Detergent with Safety Features

A solvent detergent, called Oakite Composition No. 117, which combines thorough cleaning ability with safety of operation has been announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. This solvent removes grease, oil, and smut from machinery where water cannot be used. It has a flash point of 185 degrees F. (Cleveland cup) and an exposure tolerance rating two and a half times greater than trichlorethylene and 20 times that of carbon tetrachloride.

It is used full strength and is applied by brush, immersion, or a non-atomizing spray. No rinse is necessary—parts may be blown dry with compressed air.

Sprayable Plastisol Finishes Developed for Machinery and Castings

A series of sprayable plastisol finishes for use on all types of manufactured metal goods, production machinery, and castings has been announced by Auburn Button Works, Inc., Auburn, N. Y. The vinyl coatings can be applied to any metal surface by standard spray finishing apparatus and are known as "Flintlok" and "Tufkote."

There are three Flintlok compounds, 40, 41, and 42. Flintlok 40 adheres well to any metal surface without need for a primer undercoat and presents a flinty surface which is resistant to abrasion. Flintlok 41 has the same characteristics but includes a suspension of fine metallic flakes that give the appearance of silver or gold. Flintlok 42 has the same characteristics as 40 but comes in metallic lusters and opalescent sheens of any hue. These coatings will not scratch, chip, crack, or peel and have a high resistivity to chemicals of all kinds. Applications include finishes for storage tanks, shop machinery, industrial apparatus, and metal products.

Tufkote plastisol sprays provide a thicker, more cushiony coat in a variety of textures ranging from shiny or satin surfaces to pebble, wrinkle, or leather grain finishes. They can be used to fill and cover rough pitted or porous metal surface. Grinding and polishing operations on castings and forgings can usually be eliminated or reduced to rough clean-up because of the compensating quality of these materials.

There are five Tufkote compounds, 20 through 24. Tufkote 20 and 21 contain 100 per cent solids and can be applied in one operation for a wrinkled or textured finish. Tufkote 22, 23, and 24, are 90 to 95 per cent solids. All of these compounds have good insulation properties, good sound-deadening qualities, and good abrasion resistance. They are suitable for all kinds of metal handles, wire coating, hardware, machinery, and any other metal objects where a durable, elastomeric, chemical-resistant finish is desired.

Process for Coloring Copper and Its Alloys

The development of a process called "Enthocolor 220" for producing brown and shiny blue-black coatings on copper and copper-base alloys has been announced by Enthone, Inc., 442 Elm St., New Haven, Conn. The coatings produced are oxides, subsequently crystal-spotting does not occur. Uniform brown colors can be produced on copper and its alloys, while blue-black and brown colors can be produced on brasses containing 20 per cent or more of zinc. The adhesion of the finishes is good. Coated work can be severely deformed without causing the coating to flake.

The material is supplied as an alkaline-salt mixture and is used in a temperature range of from 180 to 225 degrees F. Parts to be colored are given the usual preparatory treatment and are then immersed in the prepared solution for periods of from 1 to 15 minutes.

Rubber Enamel Coating that Protects Hydraulically Operated Equipment

The Saran Protective Coatings Co., 2415 Burdette Ave., Ferndale 20, Mich., has announced the availability of a synthetic rubber enamel for pro-

tecting the finish on hydraulically operated equipment. "Pliogard," as it is called, is a high-solids, chemical-resistant, synthetic-rubber coating made from styrene butadiene resins. Applied by spray, brush, dip, or roller methods, it air dries dust-free in thirty minutes to a tough adherent film on metal, wood, or concrete. The coating does not oxidize, will withstand temperatures up to 250 degrees F. continuously and higher for intermittent service, and is unaffected by the leakage of hydraulic fluids. It is particularly useful in the automotive field, where it is employed to protect and decorate hydraulically operated equipment in automation lines.

Powdered Acid Material which Removes Rust and Scale

A dry acid compound which removes corrosion materials from metal surfaces has been made available by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. This material, called "Oakite Drycid," is added to water in concentrations of upwards of 8 ounces to the gallon. Solutions may be used cold or, if a faster action is required, at temperatures up to 165 degrees F. Since this material is supplied in powder form, it can easily be shipped and stored. The material has a mild aromatic odor and is non-fuming.

Threading Oil for Machining Tough Alloy Steels

The development of a cutting oil for reaming, drilling, broaching, and threading of tough alloy steels has been announced by H. & B. Petroleum Co., 799 E. 25th St., Paterson 4, N. J. This threading fluid, called "Habcool 318 Tapping Oil," is said to facilitate the machining of alloys that could not otherwise be machined. It is applied in small quantities by brush to the tools.

Bonding Process for Joining Carbide to Steel

A process that is claimed to join carbide to steel in a union strong enough to withstand almost any punch-press operation without separating the intermediary alloy from either the carbide or steel has been announced by Welded Carbide Tool Co., Inc., 62-68 Colfax Ave., Clifton, N. J.

This process is known as "Weldalloy." There are two joining materials, Weldalloy A, used as an intermediate material between carbide and steel, and Weldalloy B, used as a casing material to reinforce carbide inserts. The hardness of Weldalloy A can be varied from 20 to 50 on the Rockwell C scale. Heat-treatment may be applied to air-hardening steel after joining with carbide, so that the entire piece may be brought to any desired hardness. Core-rods for dies for powder metal parts are made in this way.

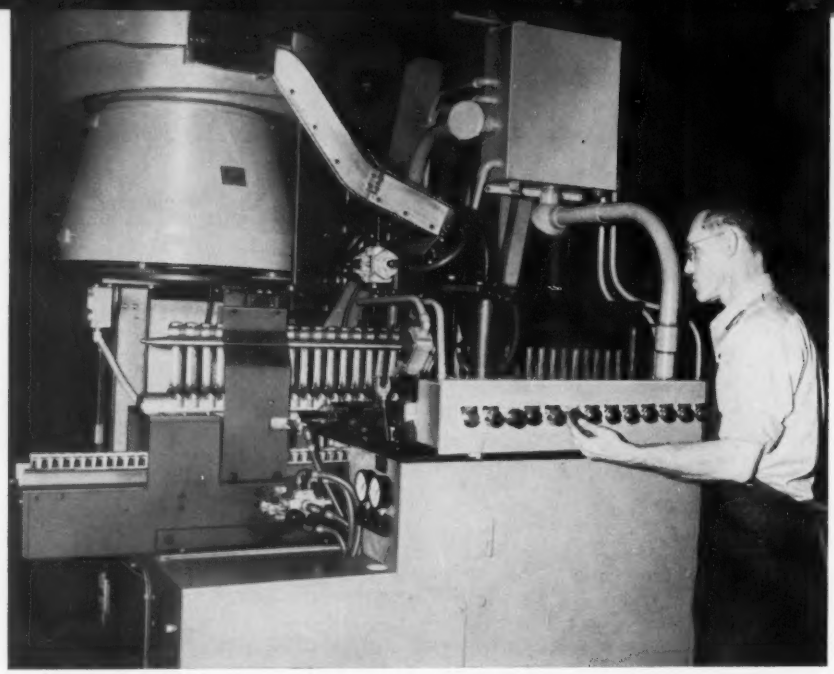
Weldalloy B alloys are readily machinable, having a hardness range of 80 to 100 on the Rockwell B scale, as molded. They are used as jackets around carbides or as cores. The company applies the Weldalloy process to any grade of carbide on inserts of its own manufacture or carbides procured from other manufacturers.

Series of Flat Circular Teflon Discs Now Available

A line of flat circular Teflon discs has been added to the basic shapes of Teflon now available from Allegheny Plastics, Inc., Box T, Coraopolis, Pa. The discs are available in even-numbered sizes from 4 to 18 inches in diameter, in thicknesses of 1/16 and 1/8 inch.

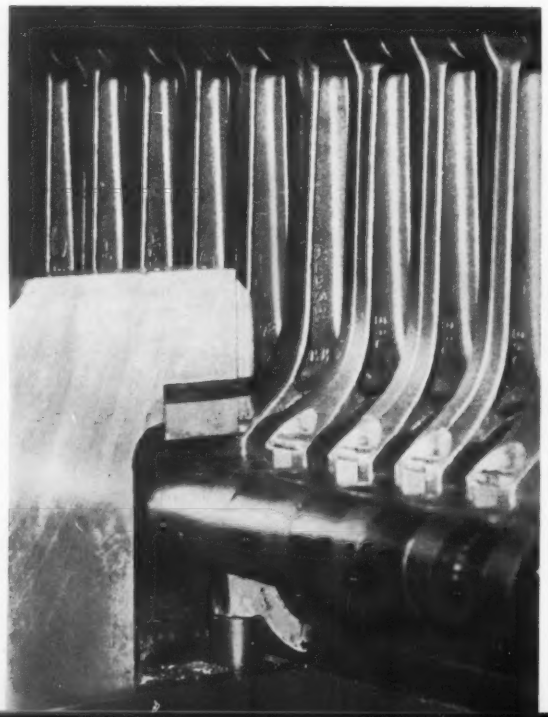
Savings resulting from the use of discs, through elimination of waste on corners of regular sheet material, amount to approximately 1/2 pound in the case of a 1/8-inch disc 18 inches in diameter versus a 1/8-inch sheet 18 inches square.

The appearance of dials used on machine tools produced by the Kearney & Trecker Corporation, Milwaukee, Wis., has been improved by the use of 17-4 PH (precipitation-hardening) stainless steel available from the Armco Steel Corporation, Middletown, Ohio. The stainless steel dial shown on the right has been machined, graduated, and heat-treated. Formerly, dials were chromium-plated.



Automatic Machine Speeds Connecting-Rod Assembly

ASSEMBLY of connecting-rods prior to final machining has been stepped up by a new automatic machine. Developed by the Ingersoll-Rand Co., New York City, this machine is of the straight-line transfer type that can be operated either as a disconnected unit or as an integral part of an automatic line.



Although the normal operating rate is 700 connecting-rods per hour, it can be cycled at 900 per hour if necessary. The entire assembly machine, which can be seen in the heading illustration, is provided with electrically controlled pneumatic operation. Should jamming occur at any point, damage will be prevented.

In the final installation, connecting-rods and caps will be magazine fed. The connecting-rods are supported from below by a half-round guide block, and from above, by two horizontal rods bearing against the under side of the piston-pin bosses. Caps ride with their open end up on two tapered rails located below the mating parts.

This loading end of the machine functions as a lift-and-carry conveyor that advances the rods and caps until they reach a positive index mechanism. Here, transfer fingers grasp the rods, align them with the operating station, and return to the start position.

At the first station, one bolt is inserted at each side of the connecting-rod, and light pressure is applied to maintain proper orientation of the bolt head. The partially assembled unit is advanced to a second station, where the bolts are forced

Fig. 1. Heavy pressing finger drives one of two bolts home. It then retains the bolt in position while a cap is assembled from below.

home by a pair of heavy pressing fingers, one of which can be seen in Fig. 1. At the same time, with the fingers still holding the bolts in position, a cap is pressed over the bolts from below. This can also be noticed in the illustration.

During transfer from this point to the third and final assembly station, the bottom surface of the cap rides in contact with a rail and thus is retained in position. At the third station, nuts are fed through the hollow offset spindles of a pair of air motors and are driven on the bolts to the proper torque. When the spindles have been retracted, transfer fingers automatically unload the assembled connecting-rod by pushing it off the end of the support bars.

Bolts are fed by a Peeco vibratory hopper to an inclined chute, Fig. 2, where gravity provides the moving force. Due to the non-symmetrical, oval shape of the heads, the bolts are directed through an orienting device that takes the form of a horizontal slide, just below and to the left of the feed chute. As the slide reciprocates, the bolts are aligned with two appropriately shaped tubes that lead them to the connecting-rod holes.

Nuts are handled by a Feedall elevator type hopper, Fig. 3. They are picked from bin and raised until they are in line with two down-chutes leading to the back end of the machine. The nuts enter the machine frame below the working level and are directed to the bottom end of the pneumatic nut-runners.

Two vertical rods (one for each nut-runner) elevate, contact a pair of fasteners, and raise them to the air motors. There they enter the hollow hexagonal drive spindles, pass into socket heads, and are driven onto the ends of the bolts. The nuts are tightened automatically to a torque value of approximately 45 foot-pounds.

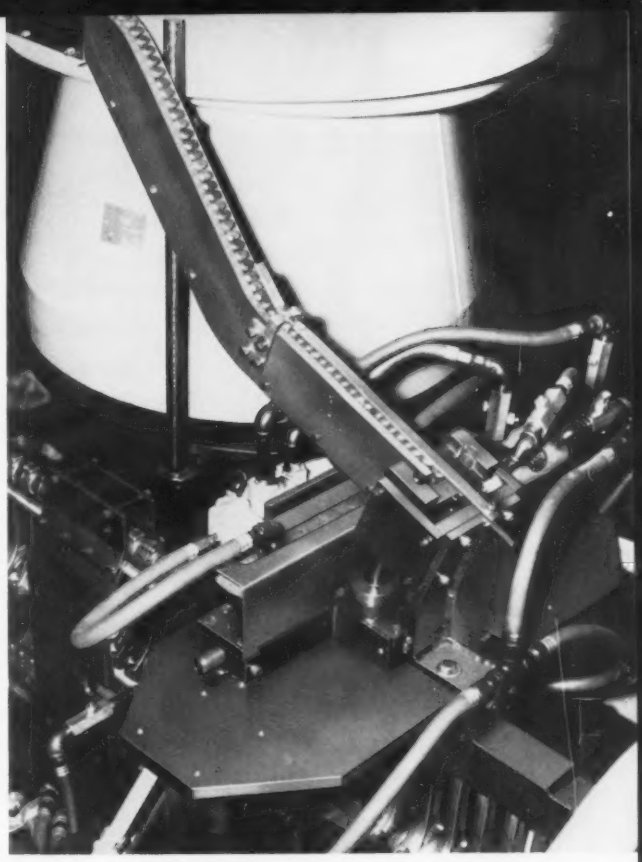


Fig. 2. Bolts are being fed down from a vibratory hopper. Because the bolts are not symmetrical, a reciprocating unit (below the chute) is used to orient the fasteners before assembly.

Should a bolt, nut, or cap be missing from any station, the condition is detected, and the information made known to the operator by signal lights. Simultaneously, the machine stops and switches from automatic to manual control. After correction, automatic cycle can be reinstituted.

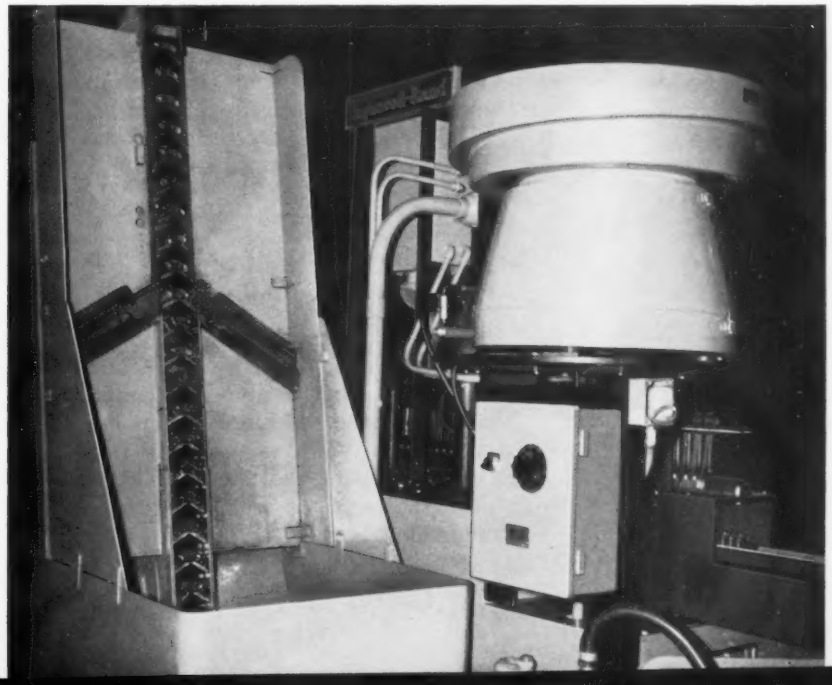


Fig. 3. Elevator type of feeding unit discharges nuts into chutes leading to rear of machine. They are then pushed through the hollow spindles of two pneumatic nut-runners and assembled to connecting-rods.

Operation of three-dimensional milling machine being monitored from control console. Control tape is "read" by machine control unit located behind operator. Plug-in electronic units are indicated by pull-knobs.

Numerical Controls to Speed Aircraft Production

WHAT is described as the first practical application of a punched-tape control system to a large three-dimensional milling machine has been built to the specifications of the Martin Co. by the Research Laboratories Division of Bendix Aviation Corporation. This new manufacturing system makes use of electronics to put coded information, taken from blueprints, onto tape and then "read" it in operating a 50-ton milling machine. Precision structural parts for aircraft and missiles can be completed automatically.

To use this system, the engineering drawing is modified to the extent that all dimensions are given either perpendicular or parallel to a predetermined reference point. The numerical drawing describes the part mathematically in relation to this point. Required dimensions from this drawing are put down on a process sheet. These figures are then typed on a standard Flexowriter that simultaneously produces a preliminary code-punched tape. The preliminary tape is used to produce, by means of a computer, the final punched tape that is fed to the machine control unit.

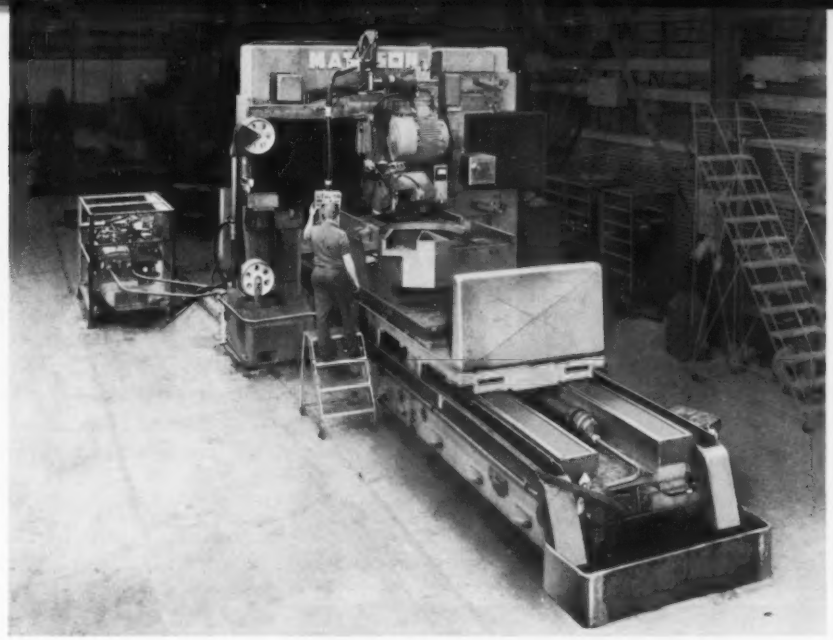
Self-checking features in the tape preparation system detect and correct any errors that may have entered into the process tape. Errors in the control tape are detected by the machine control unit as it translates the information into three-dimensional cutting operations.

Work-pieces as large as 48 by 144 inches can be accommodated, with no overhang, on the horizontal-spindle contour milling machine. The machine tool portion of the production system was built by the Kearney & Trecker Corporation. All of the cutting motions are continuously monitored by feedback instruments capable of detecting a movement as fine as 0.0002 inch. Manual operation is by means of dials and push-buttons rather than by handwheels. Provision is made for precision gaging so as to permit replacement of worn tools before the specified limits of accuracy have been exceeded. Operation of the milling machine is monitored from a console.

° ° °

Removing Chromium from Copper-Plating Baths

A process for removing chromium from copper-plating baths has been announced by MacDermid Inc., Waterbury, Conn. Known as the MacDermid Chrome Removal Process, it involves treating the copper-plating solution with two prepared materials, then carbon treating and filtering. This is said to result in the complete removal of chromium contamination.



"Hall of Titans" Grinding Machines Pack High Horsepower

NEW goals in size and horsepower have been reached with the recent unveiling of four high-capacity grinding machines by the Mattison Machine Works, Rockford, Ill. With motor ratings on these machines running as high as 150 hp, increased production can be realized at lower unit costs. Both scale and a sizable amount of stock can be removed from tough tool-steel forgings in a single pass.

Either horizontal or vertical spindles can be provided on the Plano surface grinder shown in Fig. 1 and in the heading illustration. The machine combines some of the features of an open-side planer and a conventional, double-upright planer. Horizontal-spindle motors can be provided in the range of 30 to 75 hp at 1200 rpm, and vertical-spindle motors are available in the range of 25 to 60 hp at 900 rpm. Tables currently

Fig. 1. A large casting is being finished on a Plano surface grinding machine. Either horizontal or vertical spindles can be provided in ratings up to 75 hp.

Fig. 2. Vertical machine column is being ground from the rough on this face grinding machine. The spindle is driven by a 150-hp motor.

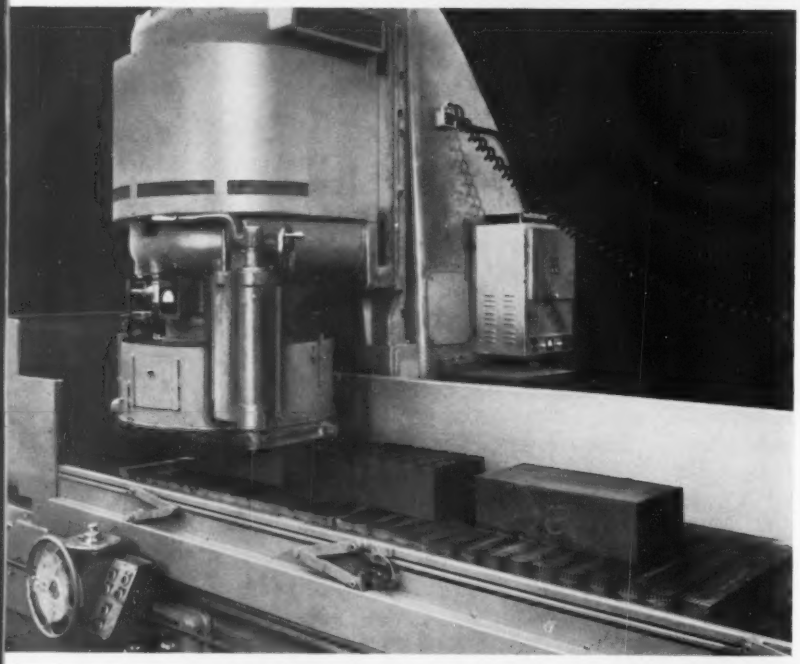


Fig. 3. Cast-iron counterweights, both solid and relieved, demonstrate the variations in power required during a grinding operation on this 100-hp, vertical-spindle grinding machine.

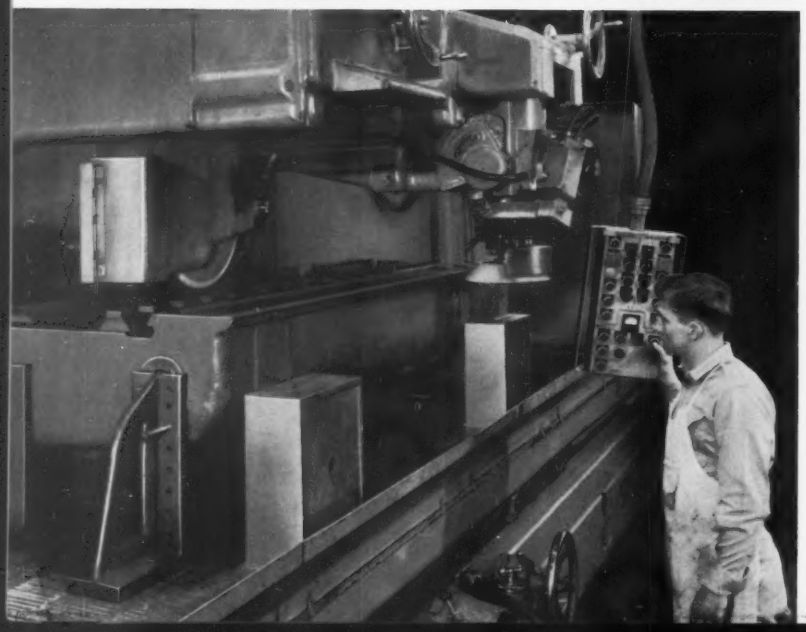


Fig. 4. Several surfaces on a lathe-bed casting are being ground in one setup on a way and surface grinding machine. The vertical spindle (right) can be tilted.

available are 50 and 60 inches in width and from 10 to 30 feet long. Grinding-wheel size for the horizontal-spindle machine is 24 inches in diameter by 6 inches wide; for the vertical-spindle machine a 20-inch diameter segmental wheel can be used.

Complete pendant control is provided for all machine functions. A "reverse out" button moves the table to the out position for loading and automatically stops the machine. Both hydraulic and mechanical cross-feeds are provided. The cross-feed and the vertical feed are adjustable in micrometer increments.

The 900 SS face grinder, Fig. 2, not only is equipped with a 150-hp spindle motor, but it can withstand brief overloads of up to 100 per cent while taking 1/4-inch deep roughing cuts on unmachined castings. Table size is 36 inches wide by 94 inches long. A segmental grinding wheel, 48 inches in diameter, is used because of its fast-cutting characteristics and the close control obtainable. The work is held by a magnetic chuck. Coolant reservoir and all machine controls are available for normal preventive maintenance.

Fast stock removal and precision finishing of flat horizontal surfaces are features of the 400 SS vertical-spindle surface grinder shown in Fig. 3. A 32-inch diameter segmental grinding wheel is driven by a 100-hp spindle motor over a 28-inch wide by 102-inch long work-table. For maximum protection, the pressure lubrication system is tied in with the electrical circuit, so that the machine is automatically stopped if the pressure drops below a safe operating level.

A variety of surfaces in different planes can be handled in a single setup on the combination way and surface grinder illustrated in Fig. 4. The machine can grind both V-ways and flat ways, and dovetails, shoulders, edges, radii, and contours in one setup.

Horizontal-spindle motors are available from 50 to 75 hp. A vertical spindle, which can be tilted to an angle of 45 degrees from either side of the center line, is driven by a 15-hp motor. The main grinding wheel is 20 inches in diameter with a 6-inch wide face; the cup wheel is 12 inches in diameter. These are supported over a 42- by 120-inch work-table.

A self-contained truing device for the vertical spindle is adjustable from 30 to 60 degrees to dress the wheel for dovetail cuts. The horizontal-spindle wheel dresser is hydraulically powered.

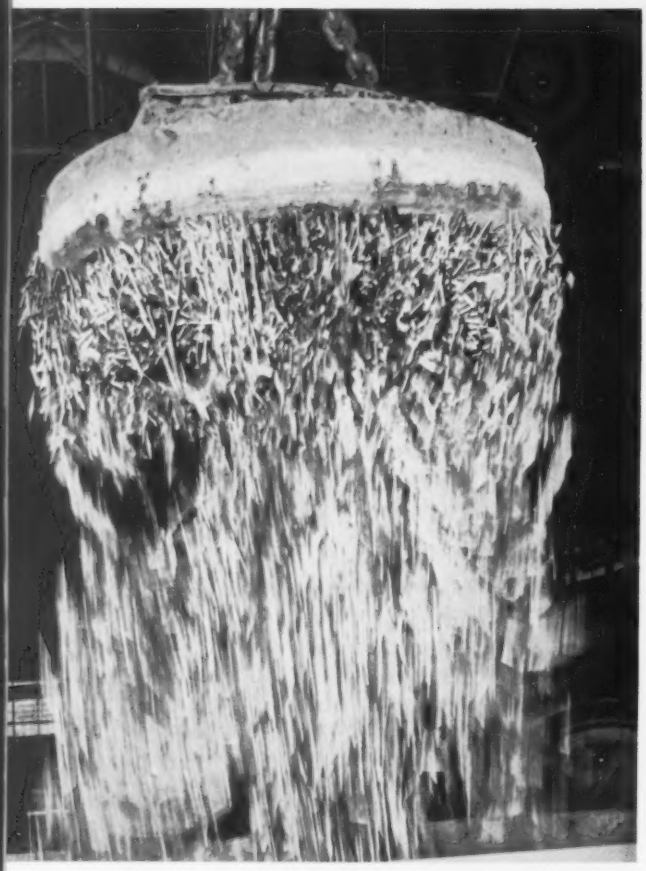
Hot-Heading of Titanium Bolts Expedited with Carbide Dies

Cemented carbide dies for hot-heading are being used at the Voi-Shan Mfg. Co., Culver City, Calif., to increase the production of titanium bolts from 150 to 2500 per hour. Employed as fasteners for aircraft components, these bolts are hot-forged, in order to obtain good physical characteristics.

Blanks made from titanium of the RC 130 series are first placed in the coil of an induction heater and heated to about 1500 degrees F. for three seconds. Following heating, the blanks are inserted, one at a time, into the die of the heading machine. The operator trips the press to form and eject the bolt while inserting another blank in the induction heater.

Special precision dies produced from Carboloy grade 190 cemented carbide turn out as many as 50,000 of the larger size bolts before showing any signs of wear; on smaller diameter bolts, this number is increased up to 100,000 pieces.

Titanium bolts produced by hot-heading with carbide dies are upset to final size.

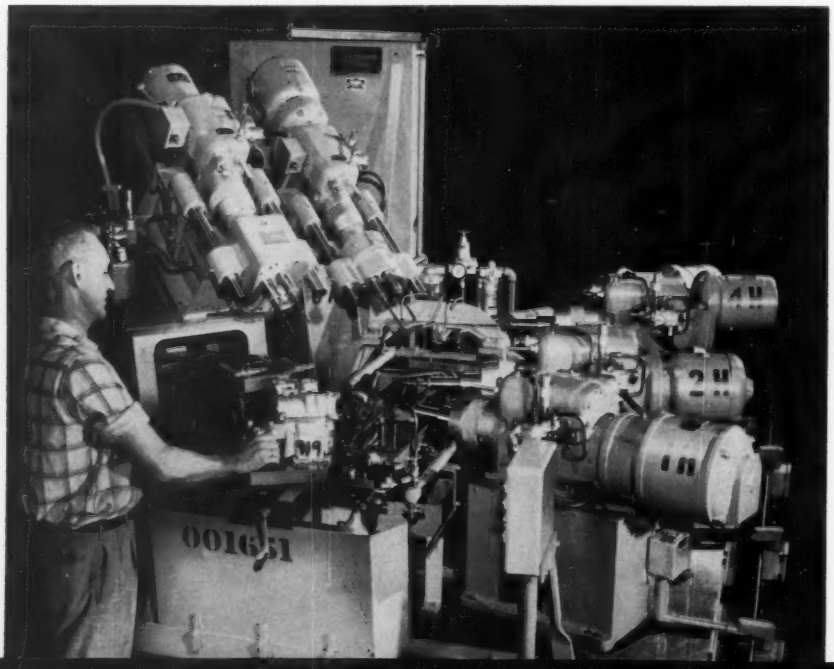


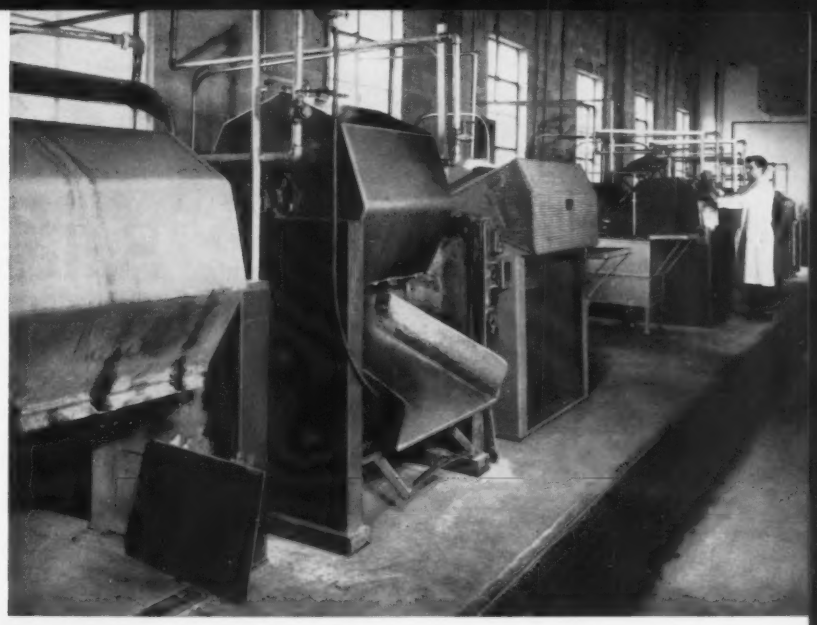
IN SHOPS AROUND THE COUNTRY

Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

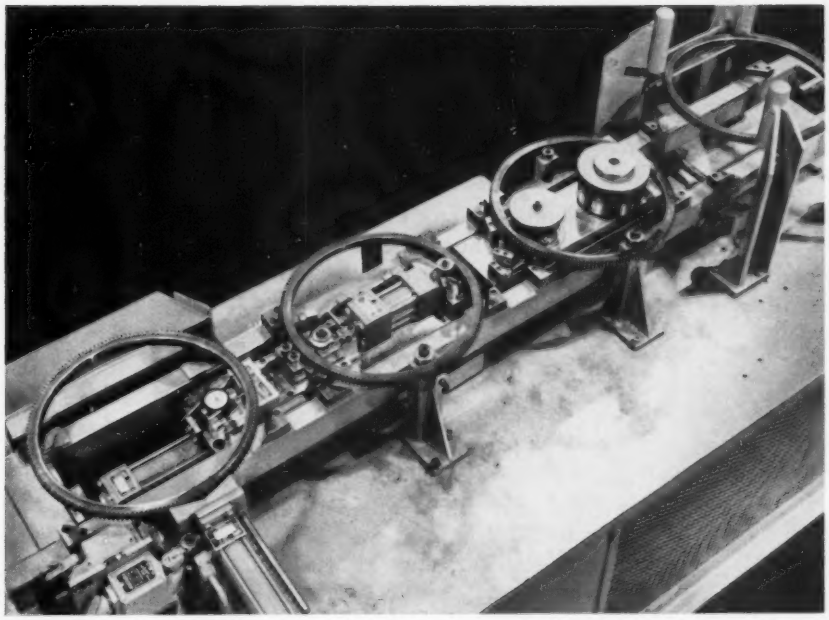
MAGNETIC APPEAL—On their way from lathe to furnace are 12 tons of chips removed in turning a giant steel roll at Ohio Steel Foundry Co., Lima, Ohio. Carbide tools used (Carboloy 370) produce thick, rechargeable chips, saving company current scrap price of $10 per ton.

NEW DRILLING ANGLE—One of a battery of Hartford-Special automatic, multiple-head drilling machines recently put to work at Hamilton Standard, Windsor Locks, Conn. Drilling holes of different size, angle, and depth in upper and lower housings of jet-engine fuel controls, the machines account for 112 separate operations.



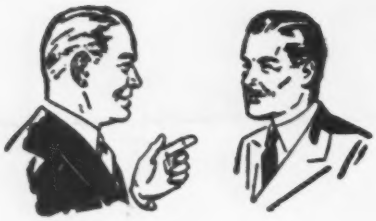


NO TUMBLE-DOWN SHACK—Section of tumbling shop of new research center for barrel finishing of metals and plastics at Lord Chemical Corporation, York, Pa. Shop has thirty barrels of every available type, from 3-inch octagonal drum, 6 inches long, to huge two-compartment 36-inch drum, 60 inches long.



MIDWESTERN ROUNDUP—At the Buick plant in Flint, Mich., a Cargill Detroit machine automatically corrects ovality in flywheel ring gears. Parts are fed to walking-beam conveyor (upper right) which carries them through "straightening," gaging, and unloading stations. Corrected rings are round to 0.007 inch, total indicator reading.

CERAMIC SPEEDSTER—In research project sponsored by Warner & Swasey at Ohio State University, ceramic-tooled turret lathe cuts 1040 steel at record speed of 16,454 surface feet per minute. Work-piece is a 13-inch diameter blank, cut is 0.040 inch deep, and feed is 0.011 inch per revolution. Heavy-duty drive motor is coupled to spindle through step-up gearing.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Who Will Make Your Present Equipment Obsolete?

LET'S hope it will be you—not your competitors—who will make your present equipment obsolete. Sales managers are harrassed and, too often, an attempt to develop new products is delayed because it doesn't appear to demand immediate attention, or seems to be the entire responsibility of others.

The corporate bone yard is crowded with the remains of companies that have expired due to the lack of a dynamic product-improvement-development program. Obsolescence follows an insidious path. Like termites in the house, costly damage is done before the owner discovers it.

Have you ever noticed the selective use of either "we" or "they" when referring to success or failure? Entertaining a guest at golf: "*We* have excellent greens." Or again: "*They* have done a poor job on the fairways." Similarly, sales managers are inclined to use "they" in connection with the inadequacy of a product-improvement-development program. But those charged with research, experimentation, and creative design are not solely responsible. The more so since technical development is increasingly focused on customer acceptance.

Although basic research requires the isolation of "ivy clad" walls, applied research and its younger brother, consumer research, must work hand in hand. The old concept of what the customer *ought* to have is now blended with what the customer *will like*. Qualitative and quantitative measurement of the latter is a science. Men in laboratories and men in markets both yield new ideas by research.

With a concern for a product-improvement-development as an essential to life and advancement, here are pointers taken from the notebooks of a few experienced sales managers.

1. Promote within your own organization the very same philosophy you promote with prospect and customer—product improvement as a necessary investment. Picture to your top management and to your technical staff the high cost of tardiness.

2. Have your market research group originate ideas for new products and product improvement, as well as assemble and evaluate them. A record of creating orders cannot be maintained without a program for creating new equipment.

3. Guide product development programs, because they suffer most often from fickleness. It is so easy to let slack business retard development work rather than hasten it.

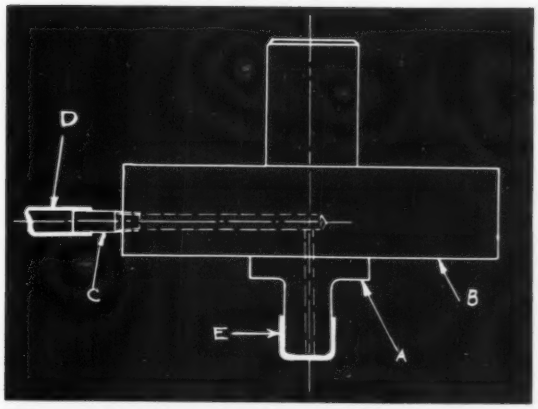
4. Analyze customers and processes to determine not only the opportunity for new products, but also new applications for what you now build and sell. One equipment builder has maintained a pilot laboratory for processing customer products by the use of his machinery. He suddenly realized that this setup had been exclusively a sales tool for the field force. The laboratory was reorganized and now also is used for product development.

5. Encourage development and design engineers to visit customers. Help open the windows of the laboratory and drafting room to the fresh air of the market.

6. Cooperatively establish targets and define accomplishment. The record of an equipment development program has often been marred by a misunderstanding of the objective. The fruits of inventive genius cannot be defined in advance, but the traits of proposed equipment can be prescribed and their importance rated.

Neglect and lethargy in negotiating a particular sale are cardinal sins of any sales department. Yet neglect and lethargy toward developing new and improved products are far greater sins. Their effect is so severe as to relegate any business to the corporate bone yard.

SHOP KINKS



Parts are stripped from punch by air blast. Valve opening mechanism (not shown) times ejection with ram up stroke.

Air Ejector for Punch

By Roger Isetts, Kenosha, Wis.

It is sometimes impossible to design an effective stripper for ejecting the work-piece from the punch of a small drawing or forming die. If a spring or knock-out bar type stripper can not be used, the simple arrangement illustrated may prove effective.

A small hole, drilled through the punch *A*, is intersected by a larger hole drilled in the top die shoe *B*. This larger hole is tapped to receive pipe nipple *C*, and a flexible air hose *D*, attached. A valve timing arrangement allows a blast of air to blow part *E* from the punch on the up stroke of the ram.

Forming Tapers in Die Members

By Frank D. Rifner, Trotwood, Ohio

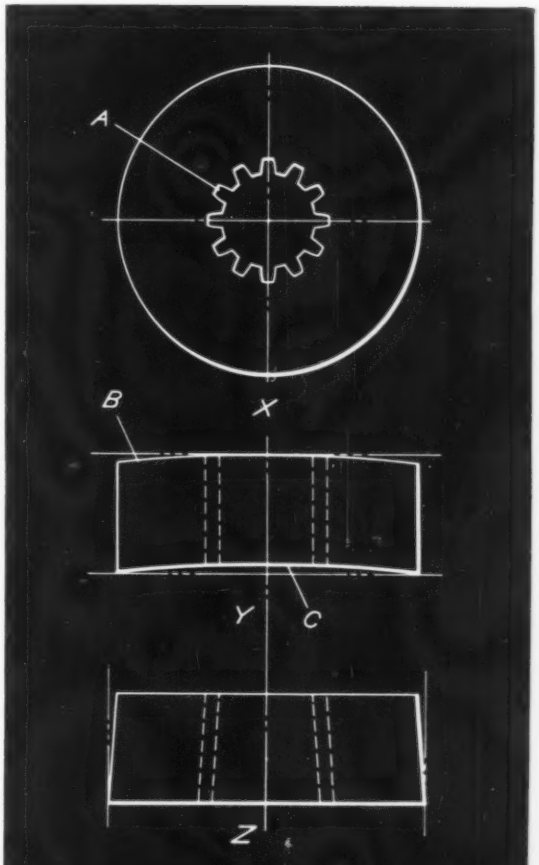
Forming an internal clearance taper in a die member is usually a tedious operation. This is especially true if the outline of the blank to be punched is of an irregular shape. With a die of this type, such as the one shown at X in the accompanying illustration, hand filing of a clearance taper would be impractical.

There is, however, a quick method of obtaining this end result. The die blank should be machined slightly oversize, following which the desired shape *A* is formed through it by broaching or any other suitable means. This will, of course, leave a blank contour with parallel sides. Then, using a lathe, the top face is formed to a convex shape *B* and the opposite face, to a concave shape *C*, as shown at *Y*. The amount that these two faces should be machined out-of-square is approximately 1 1/2 degrees.

To obtain the desired internal taper, the die member is placed on the bolster of a press with its lower, or concave face *C*, down. The part is then flattened. This will tend to contract the upper blank contour while expanding the lower one, as may be seen at Z. Rework of the upper contour will probably be necessary to provide straight sides for a distance of about 1/8 inch before leading into the tapered portion.

This procedure is particularly applicable to circular die members, due to a uniform stretching of the material. In the case of a square die, an over-size circular member should initially be used. After pressing, the part can be machined to a square shape. Sufficient stock should be allowed on the original disc to permit final truing of both faces and the outside diameter. Any required holes should be drilled after this final machining.

Clearance tapers in dies may be formed by machining their top and bottom surfaces, then flattening them in a press.



MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Development of a Sheet-Metal Cone

By DONALD E. SWEET

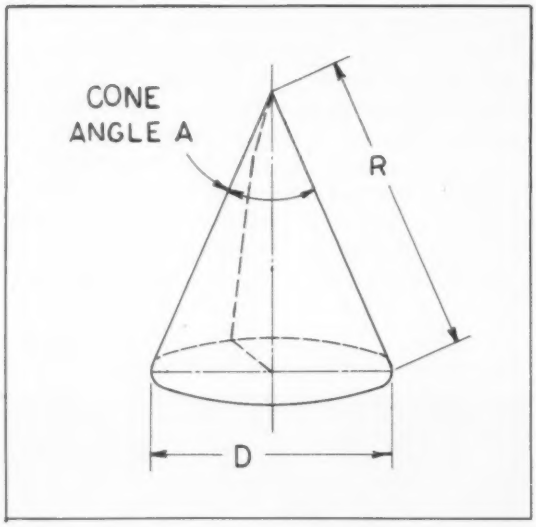


Fig. 1. Sheet-metal cone

When a cone such as shown in Fig. 1 is fabricated from sheet metal, a development must be made. To lay out this development, Fig. 2, it is necessary to determine the angle B of the wedge-shaped cutout.

Since the slant height of the cone R is always greater than the base radius, $D/2$, the perimeter of a circle of radius R will always be greater than the perimeter of a circle of radius $D/2$. Thus, the perimeter of the base circle is not long enough to cover the perimeter of the R-radius circle in the development. The wedge-shaped piece of metal left over must be cut out, although an overlap may be left for welding or soldering. How is the angle B of this cutout found?

Solution:

1. The length of wedge-arc $\overline{cd}$ is equal to $2\pi R$ minus πD, that is, $\overline{cd}=2\pi R-\pi D$

2. Angle B, in radians, is equal to $\overline{cd}$ divided by radius R;

$$B=\frac{\overline{cd}}{R}=\frac{2\pi R-\pi D}{R}$$

3. In degrees,

$$B=\frac{2\pi R-\pi D}{R}\times\frac{180}{\pi}$$

$$=360\left(1-\frac{D}{2R}\right)$$

4. If instead of R angle A is given, then $B=360\left(1-\sin\frac{A}{2}\right)$, since $\frac{D}{2R}=\sin\frac{A}{2}$

This last formula is particularly useful when it is necessary to determine angle B for many cones having different cone angles A.

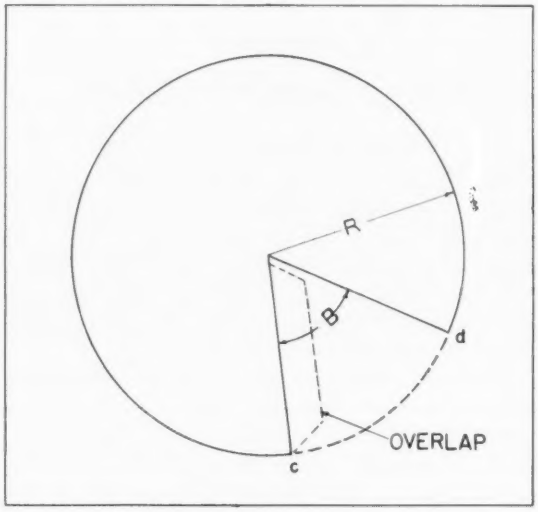


Fig. 2. Development for sheet-metal cone in Fig. 1.

MACHINERY'S
Reference Section

June 1957

Welding Stainless Steels

By RICHARD E. PARET
Stainless-Steel Specialist
American Iron and Steel Institute

Welding Stainless Steels

By RICHARD E. PARET
Stainless-Steel Specialist
American Iron and Steel Institute

WELDING plays a major role in the fabrication of stainless steel, because welded joints provide all the desirable characteristics of the basic material.

Where strength is the major reason for specifying stainless steel,welding can offer a joint efficiency of up to 90 per cent. In applications calling for high corrosion resistance, sound welds will provide full service. Where surface finish or appearance is the major consideration, welded joints can be completely blended. And, where ease of fabrication is required for economical production, welding is suited to even the most exacting specifications and production needs.

Use of structurally sound, completely blended welded joints offers unlimited freedom in design and important production economies. It is therefore essential for all designers and fabricators of stainless-steel products to have a good working knowledge of welding practice.

The technology of welding stainless steel involves an understanding of three different, but related, materials. These are the three families of stainless steel, classified according to their microstructure—austenitic, martensitic, and ferritic. Together, they comprise thirty-seven different American Iron and Steel Institute (AISI) types. In each family, one type is a basic grade, of which all other types in the same family are simply modifications.

For the austenitic steels, the basic grade is Type 302, containing a nominal 18 per cent chromium and 8 per cent nickel (18-8). Type 410 is the basic martensitic grade, and Type 430, the basic ferritic grade. Together they account for nearly 50 per cent of all stainless-steel production. While there are similarities among the three families of stainless steel where welding is concerned, each is sufficiently different to warrant separate consideration.

Austenitic Stainless Steels

All alloys in the 200 and 300 series, from Type 201 to Type 348, are austenitic in structure and contain additions of both nickel and chromium. Certain types contain other alloying elements, such as manganese and molybdenum. They offer the highest corrosion resistance, strength, and ductility available among stainless alloys. None of these types are heat-treatable, but their hardness, strength, and ductility are affected to varying degrees by cold-working, such as rolling, drawing, and stamping. Types 201 and 301 are commonly worked to extremely high-strength levels for use as structural members in transportation equipment and in many products where fabrication produces a finished product of superior strength.

As a group, these alloys are characterized by the following variations from carbon steel:

1. 50 to 60 per cent greater coefficient of expansion than carbon steel.
2. Heat conductivity only about 50 per cent that of carbon steel.
3. Melting point 150 to 300 degrees F. lower than plain carbon steel.
4. Electrical resistance 6 to 9 times greater than carbon steel.
5. Susceptibility to carbide precipitation in unstabilized grades.
6. Exceptional toughness and ductility; no danger of hardening in welds.

The combination of a high coefficient of expansion and low heat conductivity requires taking effective measures for distortion control, when welding austenitic stainless steels. Heat removal can be aided through the use of chill bars, preferably made of copper, placed under the weld area. Similar bars are placed next to the weld area and also serve as hold-downs.

When possible, parts should be welded in rigid fixtures and allowed to remain there to cool. If fixtures are not available, joints should first be tack-welded every few inches. After tack welding, the assembly can be straightened to remove any distortion before final welding, using either skip or step-back welding. Both methods help considerably in controlling warpage.

Skip welding is done by welding a few inches of the joint, leaving an equal distance unwelded, then again welding a few inches, and continuing

in this way until the length of the joint has been covered. All skipped distances are then welded. In step-back welding, a bead is laid down for a few inches, then, moving ahead an equal distance, another bead is laid back to the first, and continued in this way until the joint is complete. The length of beads used in either method cannot be specified, since personal judgment and experience are more important here.

The interrupted heat flow resulting from these methods reduces heat concentration and thus distortion, while also limiting the amount of carbide precipitation which might otherwise take place. For weldments designed to operate under certain service conditions, the possibility of this carbide precipitation must be considered. It is of prime importance where stainless-steel weldments are designed for service in highly corrosive applications and cannot be annealed after welding, or where service temperatures range between 800 and 1650 degrees F. and the part is subject to corrosive conditions.

The carbide precipitation referred to is believed to be the formation of chromium carbides along the grain boundaries of the metal as a result of heating in this range. Chromium near the grain boundaries is depleted, and there is a loss of corrosion resistance. In this state, the metal is referred to as being sensitized.

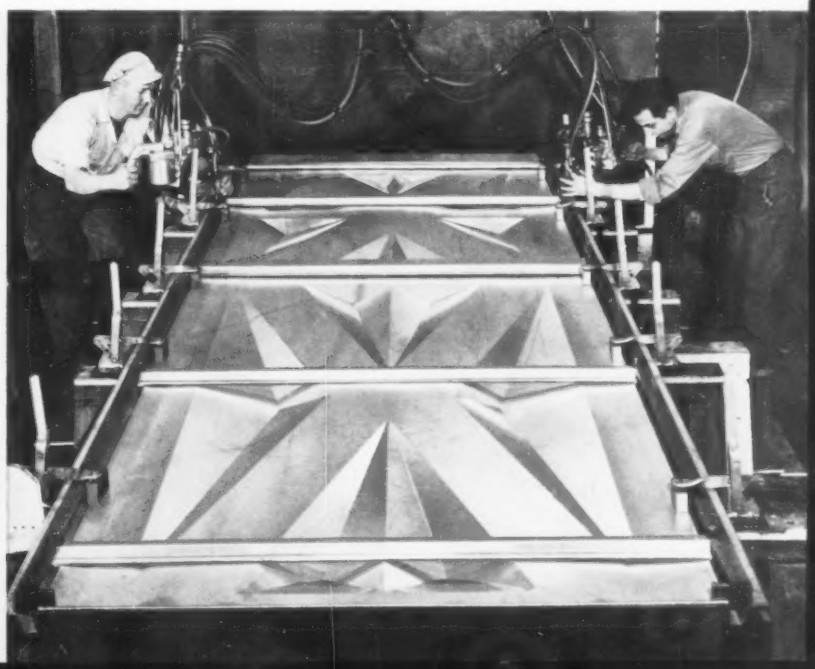
Sensitization can be minimized or avoided in simple welding by using the low-carbon grades of stainless steel, developed expressly for this purpose. These grades are Types 304, 304L, 309S, and 316L, with carbon contents ranging from 0.08 to 0.03 maximum. The lower carbon content eliminates the possibility of significant carbide precipitation during proper welding, although these grades are not designed for regular service in the sensitizing range.

In the 800- to 1650-degree F. operating range, stabilized grades are recommended. These are Types 321, 347, and 348, which contain either titanium or tantalum and columbium. Such elements are powerful carbide formers which create harmless, stable carbides with all available carbon before it depletes the available chromium.

If annealing is performed to obtain full corrosion resistance for parts operating below sensitizing temperatures, it is essential that full-solution annealing be used, which generally involves temperatures between 1850 and 2150 degrees F. Parts must be cooled rapidly from the annealing temperature; a rule of thumb is to cool parts to blackness, about 800 degrees F., within three minutes. Direct water quenching is frequently used, although parts of thin section might cool rapidly enough in air or with forced-air cooling. Large weldments, such as tanks, are usually cooled by directing high-pressure water streams uniformly over the surface. The high temperatures and rapid cooling involved can result in severe distortion unless parts are properly supported and braced. (See "Annealing Large Stainless-Steel Weldments," MACHINERY, February, 1956, page 163.)

Preliminary investigations of welding Type 202 indicate a reduced tendency toward chromium carbide precipitation. This might, perhaps, permit a somewhat higher carbon content for general-purpose weldments.

The toughness and ductility of austenitic stainless steels are not affected by welding, since



Spot-welding reinforcing Z-bars to Type 302 stainless-steel structural panels at the Commercial Shearing & Stamping Co., Youngstown, Ohio. After outer edges are welded, deep-throated units are used to weld the assembly across its width.

proper techniques, which include rapid cooling, result in fully annealed welds. This is particularly true of resistance welding, where the weld is at times tougher and more ductile than the surrounding metal. The higher electrical resistance of austenitic stainless steel plays an important part here. (Electrodes of balanced composition are commercially available for all types of austenitic stainless steel. Manufacturers' recommendations will be useful in selecting electrodes for any of the welding processes.)

Certain austenitic stainless steels require precautions because of their formulations to meet special requirements. Machinable grades, for example, are apt to yield porous welds from atomic hydrogen welding, apparently because of the reaction of their selenium or sulphur content with hydrogen. Metal arc welding of these grades also presents difficulty in the form of red-shortness, but this can be overcome through the proper electrode selection.

When welding any of the three stabilized grades, Type 347 electrodes are generally recommended because of the loss of titanium in Type 321 by oxidation. However, with inert gas welding, up to 85 per cent of the titanium in Type 321 filler wire can be retained in the weld deposit, thus assuring adequate stabilization.

Ferritic Stainless Steels

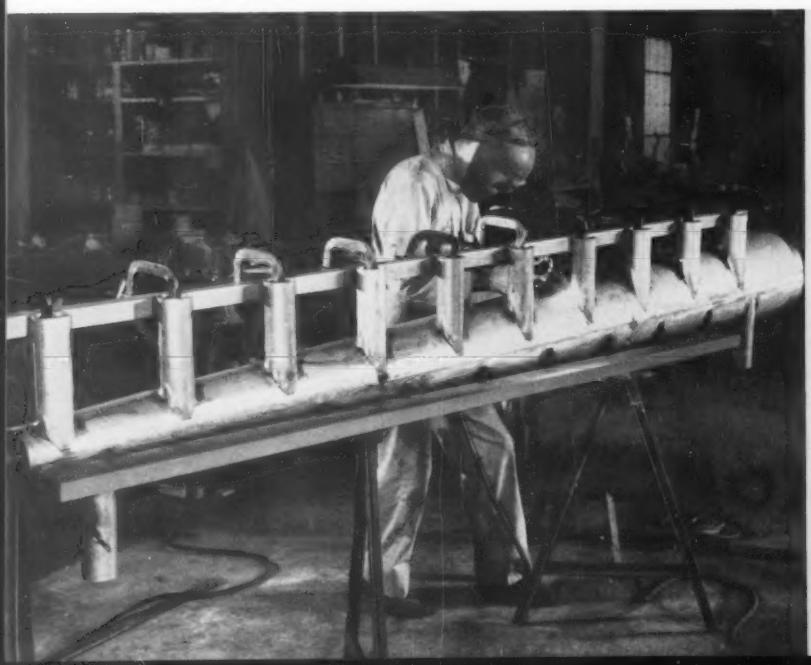
Ferritic stainless steels comprise five types in the 400 series, of which Type 430, containing 14 to 18 per cent chromium, is the basic alloy. Unlike the austenitic grades, their coefficients of expansion are equal to, or less than, that of carbon steel. Their heat conductivities are slightly higher than the austenitic grades. As a result, distortion is less of a problem. Also, melting points are closer to that of carbon steel. They suffer, however, from a susceptibility to grain growth and room-temperature embrittlement after being subjected to heat (around 2000 degrees F.) for extended periods. Such grain growth can affect appearance, corrosion resistance, and ductility.

Although weldments of these alloys are not generally recommended for room-temperature use where vibration, shock, or deformation are factors, their serviceability in innumerable applications involving welding is not materially affected. Currently, Type 430 is used in larger tonnages than any other single type of stainless steel.

It is also important to note that as toughness increases with relatively low increases in temperature, weldments of ferritic stainless steel subject to vibration, shock, or even some deformation might be perfectly satisfactory for use at 200 degrees F., or higher, up to the maximum service temperature of the material.

The ductility of welds in ferritic alloys can be improved slightly by a postheat-treatment at 1300 to 1450 degrees F. for one hour, followed by rapid cooling. This annealing, however, cannot refine the grain. Peening is also effective in providing additional ductility; it can be done either at room temperature or annealing temperature. In either instance, it should be followed by additional annealing.

The selection of filler wire or electrodes for ferritic alloys deserves careful consideration. Welds made on Types 430 and 446 with chro-



Inert gas welding a header used for a paper mill. The assembly is made of Type 304 stainless steel, 1/8 inch thick. Welds are made with a 3/32-inch tungsten electrode, using Type 308 filler rod.

Roll spot-welding side panels for an automotive trailer at the Budd Co., Philadelphia, Pa. Spot-welds are made by narrow copper rollers at regular intervals along seams.

mium (ferritic) filler metal are not as tough and ductile as those made using chromium-nickel (austenitic) filler metal, although a better color match can be obtained with the former. If Type 430 filler is used, preheating to a minimum of 300 degrees F. and postheating are generally desirable. Even with this filler metal, however, a line of demarcation in the weld will be evident because of grain growth. Sometimes, this can be minimized by peening, as mentioned.

To obtain optimum mechanical properties from a welded ferritic structure when heat-treatment is not feasible, austenitic filler (such as Types 308, 309, or 310) is recommended, because the weld bead remains austenitic. In its as-welded condition, the bead will withstand more impact than the adjacent heat-affected area of the work. Thus it is possible, though not recommended, to weld ferritic structures without postheat-treatment and still obtain reasonably ductile joints. However, because of the difference in the coefficient of thermal expansion, austenitic electrodes are not recommended for equipment subject to thermal changes or corrosive environments where galvanic action might result from joining dissimilar metals.

Type 405 is a ferritic alloy which is specially modified for welding, having a lower chromium content and an addition of aluminum to retard hardening. It is used in relatively small tonnages because of its reduced corrosion resistance, as compared to Type 430. Either ferritic or austenitic filler metal can be used for this grade; a postheat-treatment is recommended in either case, but with austenitic filler, metal structures can be used as-welded for applications where little stress or shock is involved.

Martensitic Stainless Steels

In the martensitic family there are ten standard types of stainless steels, of which Type 410 (with 11.5 to 13.5 per cent chromium) is the basic grade. Composition is such that hard, brittle martensite is developed on cooling from welding temperatures. Heat conductivity and coefficients of thermal expansion are similar to those of ferritic alloys.

In most cases, preheating and postheating will be required when welding, the selection of the specific heat-treatment being largely dependent on carbon content. However, the ratio of chromium to carbon is also important, since heats containing high chromium and low carbon might have an appreciable amount of ferrite, which, in turn, can have a beneficial effect by reducing the tendency to crack when welding. Occasionally, it is possible to eliminate preheating when welding Type 410, if carbon content is low and section thickness under 1/8 inch. In this case, postheating is still recommended, since even when using ductile austenitic filler metal, the heat-affected area will be brittle.

Following are recommended preheat temperatures, based on carbon content:

Below 0.10 per cent—no preheating or annealing required.

0.10 to 0.20 per cent—preheat to 500 degrees F. for welding, cool slowly.

0.20 to 0.50 per cent—preheat to 500 degrees F. for welding, then anneal.

Over 0.50 per cent—preheat to 500 degrees F., weld with high heat input, anneal.

Stress-relieving after welding must be done before parts cool to room temperature.

If needed preheat- and postheat-treatments are omitted, cracking is likely in martensitic weld deposits and in the heat-affected area of the work. Particular care is required when welding the high-carbon grades—Types 440A, 440B, and 440C. These grades are not generally recommended for weldments.

Oxy-Acetylene Gas Welding

For light-gage stainless sheet and strip, usually 20 gage and thinner, oxy-acetylene gas welding is used extensively. It is also used in inaccessible locations, where short-circuiting might occur with electric methods.

Proper work preparation is essential. Edges to be joined must be clean and free of oxide; and the work must be kept uncontaminated and isolated from other metals, particularly ordinary carbon steel. For 22 gage and lighter, a butt type flange weld is preferred; edges are flanged to a height of about 1/16 inch and then butted together. No filler rod is required, since the flanges melt down to form the bead. Edges of 16 to 20 gage material can be butted together; filler metal may or may not be required. For 14 gage and heavier, edges are usually spaced one thickness apart to permit good fusion and penetration of the filler metal.

Although a neutral flame would be ideal for oxy-acetylene welding, it is very difficult to hold, and a slightly reducing flame is therefore recommended. An oxidizing flame results in porous welds and burning, while a strongly reducing flame will cause carburization and thus brittleness in the weld, with possible loss of corrosion resistance.

A slightly reducing flame will shield the welded side of the joint, but the use of a flux to protect the under side of the work is recommended. There is a flux for this purpose available commercially; it comes as a powder and is mixed with water to form a thin paste. After applying, it should be allowed to dry fairly solidly before welding.

During welding, puddling of the molten metal should be avoided, and a knitting, back-and-forth motion used instead of the conventional weaving round-and-round motion. If a filler rod is used, it should be kept in the flame to avoid oxidation. Where possible, welds should be completed with single beads. In finishing the weld or each bead in skip and step-back techniques, the molten metal should be permitted to cool in the protection of the reducing flame.

Uncoated rods are used generally because of the protection against oxidation offered by the reducing flame. However, some operators prefer to use a little of the flux mentioned above on the rod. The following are recommended rod sizes:

Thickness of Metal	Rod Diameter (Inches)
18 gage and lighter	1/16
18 gage to 16 gage	1/16 to 3/32
16 gage to 10 gage	3/32 to 1/8
10 gage to 3/16 inch	1/8 to 5/32
1/4 inch and heavier	3/16 to 1/4

Metal Arc Welding

For stainless steels 20 gage and heavier, metal arc welding with flux-coated electrodes produces highly satisfactory joints. In thinner gages, however, it is hard to control, and might melt holes in the sheet. Carbon arc welding is not recommended for any of the stainless steels.

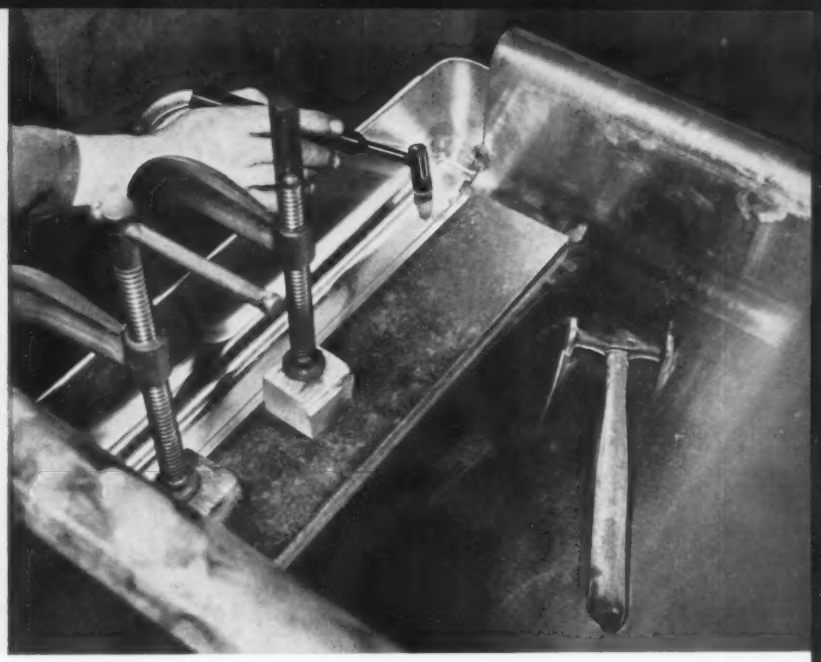
Both direct- and alternating-current can be used in arc welding stainless steel, but recommended practice is to use direct-current with reverse polarity (electrode positive with work negative) for gages up to 3/16 inch. This provides better fusion and penetration. For heavier gages, straight polarity is frequently used. Welding current should be approximately 20 per cent less for austenitic stainless steel than for mild steel, because of the lower melting point and heat conductivity of the former.

During welding, the arc is struck by touching the work with the bare end of the electrode, using a striking motion to prevent its sticking. The arc should then be maintained as short as possible, to reduce oxidation and porosity as well as spattering. Puddling of the molten pool should be avoided, to prevent slag particles from being stirred into the deposit. Vertical and overhead welding will require a shorter arc and smaller diameter electrodes than are used in horizontal welding. If more than one pass is required, the weld should be cleansed between passes.

Electrodes are available with properly balanced wire core analysis or with compensations in flux coating, so that the weld metal matches the base metal analysis of all commonly welded stainless-steel grades. In critical applications, it is sometimes desirable to weld with a slightly higher alloy content electrode. Thus Type 308 electrodes are often used for welding all the basic 18-8 analyses.

Inert Gas Welding

Arc welding in an inert atmosphere is highly recommended for stainless steel. It involves the use of a mono-atomic gas, either argon or he-



The Oscar Fisher Co., Peekskill, N. Y., fabricates a stainless-steel sink by inert gas welding. Tack-welds, seen in the corner, prevent distortion.

lium, which flows around the electrode and serves the general purpose of a flux. Thoriated tungsten electrodes are preferred for stainless-steel welding and can be used with either alternating or direct current. Carbon electrodes are not recommended because they usually result in carbon pick-up.

If alternating current is used, a superimposed high-frequency current is recommended for its arc stabilizing effect. It is also desirable when direct current is used, since it permits striking an arc without contacting the stainless-steel surface. Straight polarity (electrode negative) must be used when welding with direct current. Direct current is preferred for welding stainless steel in some cases because of its deeper penetration and faster welding speed; alternating current is usually preferred for light gages because of better arc stability.

Both portable and stationary automatic equipment is available in which controlled composition filler wire is fed automatically. It is usually unnecessary to allow for the loss of elements as in other welding processes, because nearly all the alloy content of the filler wire is transferred to the weld. With Type 321, for example, 60 to 85 per cent of the filler wire titanium content will be transferred, making it possible to use titanium-stabilized filler wire.

Another popular inert-gas welding technique employs a consumable electrode in place of the non-consumable tungsten electrode. It is used primarily for heavier sections, over 1/4 inch, and provides very rapid welding speeds.

Of the inert gases used, argon is generally preferred, as it is more economical than helium. The high rate of dispersion of helium requires a three to four times greater amount of it than argon.

Inert-gas-shielded spot welding is an adaptation of the basic process, in which automatic equipment is used to control gas flow, current, duration, cooling, and electrode movement. A trigger-actuated gun is used with a non-consumable tungsten electrode. The process is inherently fast.

Atomic Hydrogen Welding

Atomic hydrogen welding is well adapted to stainless steels, although it is losing in popularity to the inert-gas processes. An alternating-current arc between two tungsten electrodes to dissociate molecular hydrogen, which then recombines, releases heat to the joint. It offers good control of heat, and the presence of hydrogen provides a reducing atmosphere, making a flux unnecessary. While speed is not as great as with other arc-welding processes, it is considerably faster than gas welding. Atomic hydrogen welding is particularly adapted to light-gage stainless steel, especially for complicated shapes.

In practice, a "singing," or long, arc is used for pieces 3/16 to 1/2 inch thick, with electrodes about 1/2 inch apart, and a voltage of 50 to 90. For thinner work, a "silent," or short, arc is used; electrodes are closely spaced and voltage is reduced to 20 to 40. Filler rods can be used in heavier-gage work, but in lighter gages butt type flange welds are commonly used and require no filler rod.

Submerged Arc Welding

Submerged arc welding is essentially metal arc fusion welding in which the weld is protected by a mound of granulated slag deposited automati-

cally. Flash and spatter are eliminated as a result, and much higher currents and larger electrodes can be used. It is particularly suited to welding medium and heavy plates and for large-diameter stainless-steel pipe.

Both automatic and semi-automatic equipment is available for this process. Filler metal serves as the electrode, and either alternating or direct current is used, with the work grounded.

Joint design varies from other techniques, since the deep penetration makes it possible to use much smaller welding grooves and root openings. This deep penetration, however, can cause some problems when welding dissimilar metals. When welding stainless steel to carbon steel, the weld deposit will contain one-third carbon steel, one-third stainless steel, and one-third filler metal. Therefore, a high-alloy stainless-steel filler wire will offset dilution by the carbon steel.

In addition to single-electrode equipment, multiple-electrode units are available which provide less penetration. Two electrodes used in series produce twin arcs with a current flow from electrode to work to electrode.

Stud Welding

Two variations of the arc-welding technique can be used to weld studs to stainless sheets. One method involves a flux and a ceramic ferrule which is placed around the base of the stud to retain the flux. An automatic gun drives the stud against the sheet after first forming an arc between stud and sheet to melt the joining faces.

Another method uses a stud having a small projection on the base. When the projection touches the work, a high-amperage, low-voltage discharge forms an arc which melts the base of the stud and the adjacent area of the work. The stud is then driven against the work.

Both methods produce good results, but a minimum material thickness of 0.02 inch is necessary to avoid marking on the reverse side.

Resistance Welding

Spot welding, the most commonly used resistance welding technique, is ideally suited to joining light-gage stainless-steel sheets where lapped joints are permissible. Properly used, spot welding permits a joint efficiency of 90 per cent or more, as compared with an average of 60 per cent for riveting. It is widely used for joining work-hardened structural members whose ultimate tensile strength is often in excess of 150,000 pounds per square inch.

The process uses a combination of heat and pressure to form a weld nugget between the parts being joined. The heat of fusion is developed by the electrical resistance of the work between two electrodes, according to this relationship:

$$\text{Heat generated} = I^2Rt$$

where, I = current (amperes);
R = total resistance (ohms);
t = time (seconds).

Since the electrical resistance of stainless steel is six to nine times greater than that of carbon steel, it is obvious that less amperage, or time, is required for welding stainless steel. A related method, pulsation welding, is used for joining thicker material, and involves interruption of the current flow in definite on-and-off cycles.

All grades of stainless steel will provide excellent spot-welds, with the austenitic grades particularly well-suited for this method of joining. Since the weld nugget is comparatively small, it cools rapidly.

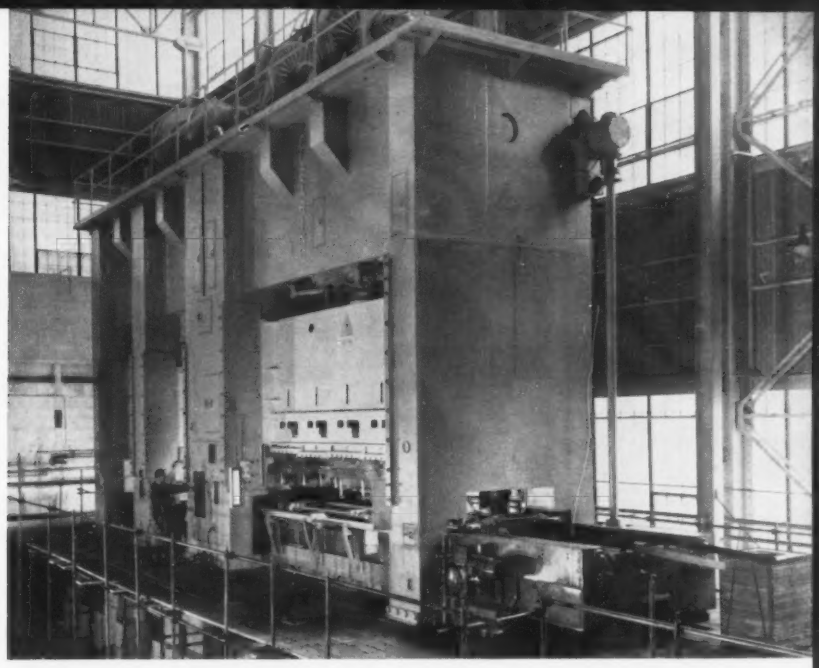
Projection welding is another variation of spot welding, in which projections on one or both of the sheets to be welded concentrate the current flow, usually from flat electrodes. It permits making multiple welds simultaneously, and is adaptable to irregularly shaped work. Pressure and current requirements must be developed individually, since they are dependent on the pressure which projections can sustain, their contact area, spacing, and material thickness.

Seam welding is an adaptation of spot welding, in which roller electrodes are used to lay down a series of overlapping spot welds, usually on lapped joints. If a pressure-tight seam is not required, the spot-welds are less closely spaced—a method referred to as roller spot welding.

Upset and flash butt welding are further variations of resistance welding used for joining stainless bar and wire. In the upset method, the parts to be joined are butted together, and a high-amperage, low-voltage current is passed between them. Melting occurs at the interface, and continued pressure forces oxidized metal from the joint to yield a sound weld. There is no splatter.

Flash butt welding is similar, except that the work-pieces are held in very light contact, causing minute short circuits which provide the heat necessary for fusion. Metal is blown out of the joint to give a flashing effect, and the pieces are forced together in molten condition under pressure. This method is preferred over upset welding for stainless steel, since oxides are easily blown out of the joint and the amount of deformation is smaller. It is also faster and cheaper.

Huge Transfer Press



Produces two stampings without changing dies

WHAT is believed to be the largest existing transfer feed press has been built by the Clearing Machine Corporation, Chicago, Ill., for the General Electric Co., Washer, Dryer Division, Appliance Park, Louisville, Ky. This Transflex press, measuring 58 feet from end to end and more than 42 feet high, features a flexible feed mechanism, an unusual combination of slide arrangements, and modular construction principles that minimize obsolescence problems.

The press, seen in the heading illustration, is used to produce two different parts without changing dies. Automatic clothes washer tops and clothes dryer tops are stamped out on alternate four-hour production shifts. Change-over from one part to another takes minutes only and is done with push-buttons.

Originally, it was intended to change the dies whenever production was to be shifted from one product to the other. However, this would have required long runs, and inventories would have to be maintained on both parts. Also, die change-over would have taken considerable time.

These obstacles were overcome by redesigning the dies so that some could be used for both parts, and developing a press which could hold all of the dies required for both parts—with change-overs accomplished by slide adjustments. In addition to reducing labor costs and down time, these innovations made it possible to revise production scheduling. Now, more frequent change-over is feasible, and inventories can be kept at a minimum.

Placing both sets of dies in a single press only increased the size from seven die stations to nine. Problems created by unbalanced loading were overcome with multiple slide arrangements. Several between-slide uprights were required, but the use of split slides reduced the over-all dimensions of the press. Split slides are a pair of slides which operate between a single set of uprights and guide against each other at the center.

Modular construction has been accomplished by breaking the press down into two basic units—two crowns and two beds joined together by a common, or Siamese, upright into one structure. Separate drives are provided for each crown, but the two are mechanically coupled. This design simplifies manufacture, erection, and shipment. Also, should more die stations be needed in the future, the modular frame components can be taken apart, additional components added, and the whole re-assembled into a larger machine. Similarly, if the large machine is no longer required, the Siamese upright can be replaced with standard end uprights to form two independent, smaller presses.

As shown in Fig. 1, the press contains a total of fifteen stations, nine of which are equipped with dies. Of these nine dies, seven are used for the production of washer tops, and six for dryer tops. A specially designed Clearing hopper feed, Fig. 2, permits continual reloading of the press without skipping a productive stroke. An overhead crane is provided on the side of the press to load special baskets of blanks onto a rotary

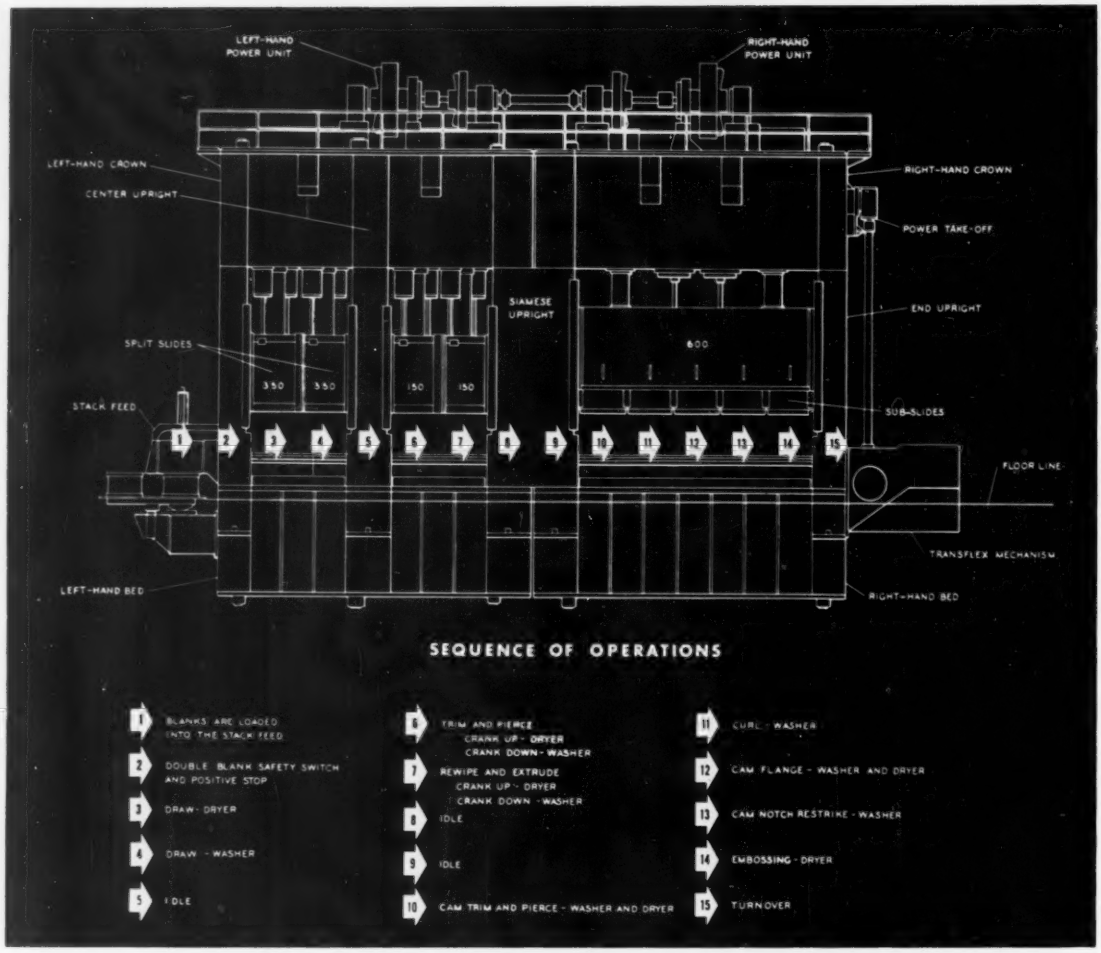


Fig. 1. Schematic drawing of the transfer press seen in the heading illustration, showing the sequence of operations performed at the various stations.

table. This table revolves 180 degrees to bring the blanks under the hopper stack. A pneumatic cylinder below the table then pushes the blanks up out of the basket and into the stack frame. Meanwhile, a pneumatic cylinder above the hopper frame continues to lift the blanks off the top of the stack by means of suction cups.

The blanks are raised one at a time to the level of the transfer feed, and fingers reach back to grip the stamping and move it on to Station 2. Here, a limit switch is provided to check the thickness of each blank passing through. Double blanks, or a blank that is considerably over-size will automatically stop the operation of the press.

The next set of feed fingers grip the blank and move it to Station 3, containing the draw die for dryer tops. This die is located on the first split slide. When dryer tops are being produced, the slide adjustment is run down to put this die into operation. When washer tops are being produced, the slide adjustment is run up to take this

Fig. 2. Basket of blanks being loaded on turntable while press is in operation. Suction cups lift one blank at a time off a supply in the stack frame.

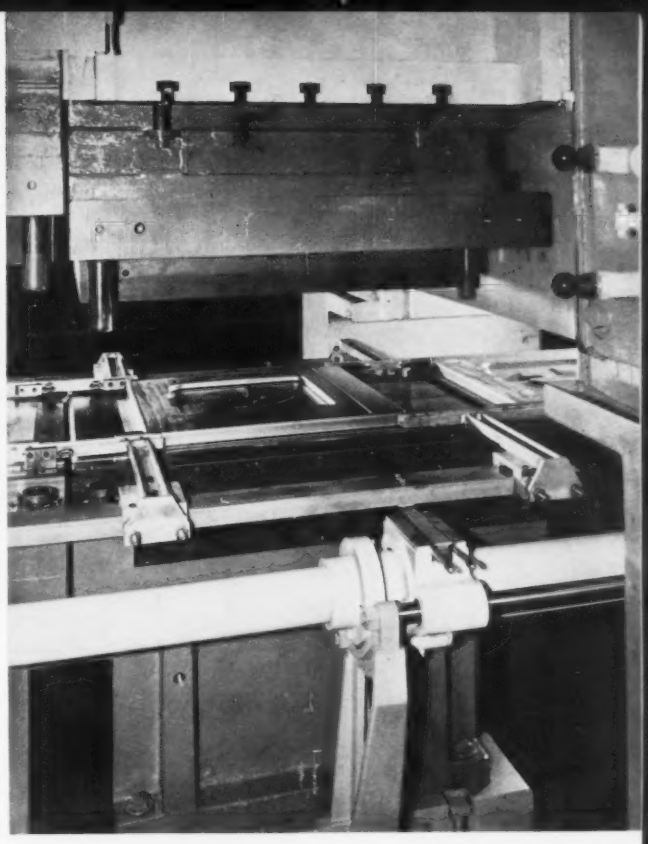


Fig. 3. Draw dies for washer and dryer tops are mounted on pair of split slides. When dryer tops are being produced, one die is adjusted upward.

die out of operation. The drawn part (or blank) is then moved to Station 4, Fig. 3, containing the draw die for washer tops. Here again, the adjustment of the slide determines whether the die is in operation.

The fifth station is located within the first upright and is idle. The sixth station contains a trim and pierce die which is used on both washer and dryer parts. However, the die contains a change-over of its own. A crank at the front of the die lowers or retracts a particular punch element which is used only in stamping the washer tops. Station 7 contains the rewipe and extrude die which also contains a retractable punch element operated by a hand crank.

Located inside of the large Siamese upright are the idle eighth and ninth stations. The tenth through fourteenth stations contain five dies, each mounted on a sub-slide which has an individual power-driven slide adjustment unit. Some of these sub-slides are used to withdraw dies from production in the same manner that the split slides were used earlier. The tenth station contains a cam trim and pierce die which is used on both washer and dryer parts. A curl die is provided at the eleventh station for use on the washer only.

At the twelfth station, a cam flange die is used on both washer and dryer parts. The thirteenth station contains a cam notch restrike die used on washer tops only, and the fourteenth station, see Fig. 4, contains an embossing die for dryer tops only. A turnover mechanism is provided at Station 15 to invert the stampings before removing them from the press. The completed stampings are pushed along runways at the outgoing end of the press, Fig. 5.

Changing production from washer tops to dryer tops, or vice-versa, involves altering five electrical slide adjustments and turning two hand cranks. Steps are now being taken to motorize these two hand-crank operations. All five slide adjustments (and eventually the extra two crank adjustments) are operated by a single button control on the master panel. A key switch is simply set to "washer production" (or dryer production) and an "automatic slide positioner" button is pressed.

The transfer feed mechanism of this press is equipped with sets of fingers which move the parts from die to die through the press. When the dies open, the fingers move inward to grip the parts; then laterally to carry the part to the next station; and finally outward to release the part in its new location as the next set of dies close on it. While the dies are closed, the fingers

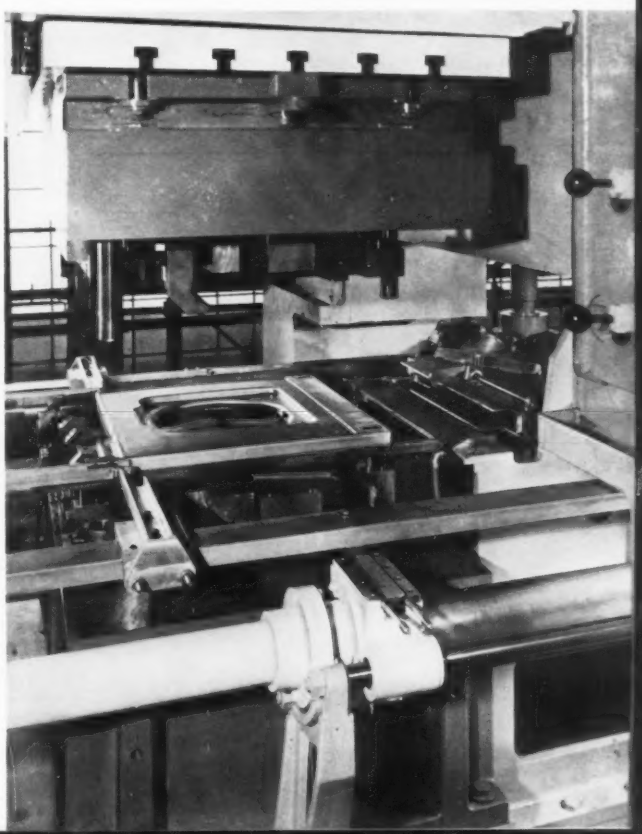


Fig. 4. Close-up view of the final die at Station 14 for embossing dryer tops only. When making washer tops, this die is made inoperative by a sub-slide.

Fig. 5. Finished stampings are pushed out of the press along runways on top of feed-box. Auxiliary motor on side of box is used to inch the feed mechanism.

move laterally back to their starting position, ready to pick up the next part.

In order for the transfer feed press to be versatile, several adjustments had to be built in. First, the fingers were made easily interchangeable so that a variety of shapes could be gripped. Second, provisions were made to vary the number of dies which could be operated in the press. The length of feed stroke was made adjustable to accommodate the different spacings between dies with a simple adjusting screw, Fig. 6, provided for changing the stroke. The fingers were made movable so that they could be spaced to correspond with the length of stroke. Cushions and knock-out mechanisms are also movable.

Finally, an additional step was taken to speed the change-over from one setup to another. The channels upon which the individual fingers are mounted were made quickly replaceable, so that channels with entire sets of fingers, preadjusted to a particular set of dies, could be clamped in or out of the press in just minutes. This eliminates the procedure of replacing and adjusting individual fingers. The feed has been designed in incremental units so that it can be lengthened or shortened easily by adding or substracting units.

Total capacity of the six-point suspension, single-action, transfer feed press is 1600 tons. The stroke of all slides is 20 inches, with each slide individually adjustable through 14 inches by motors. The press operates at twelve strokes per minute.

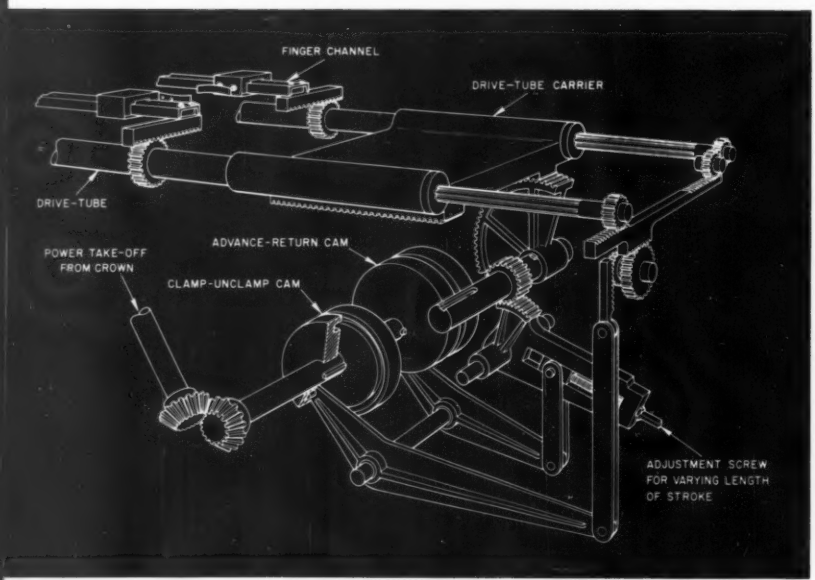


Fig. 6. Adjustable Transflex feed is powered by a constant rotary motion obtained from the press crown through a power take-off shaft. Cams and levers transmit the motion to lateral movements in two directions—advance-return, and clamp-unclamp. The length of the advance-return stroke is easily adjustable by a screw which changes the length of the secondary lever following the advance-return cam.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Ram-Operated Knockout for Second-Operation Dies

By Federico Strasser, Santiago, Chile

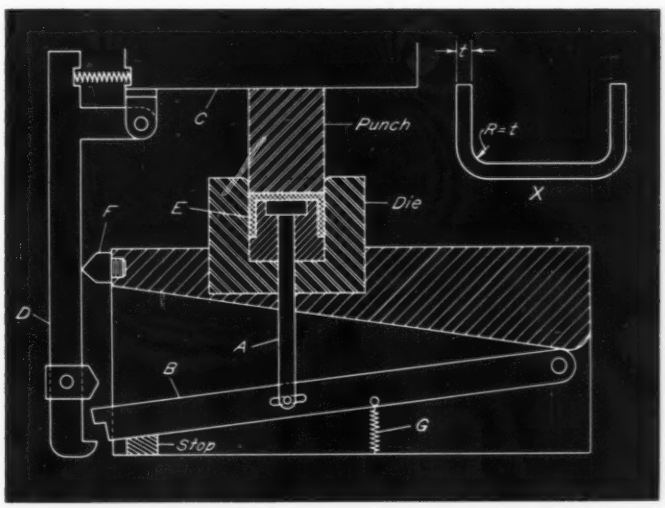
Although positive-acting, automatic ejectors are generally best, there are some instances where it is preferable to use some special design for such devices. In second-operation dies, it is possible to employ the usually inactive phase of the operation cycle for this purpose.

A certain U-shaped component—for an important functional reason—required absolutely square corners. In accordance with current practice, the work-pieces were first shaped in a standard channel type forming die with rounded edges, as shown at X—the inside radius being equal to stock thickness. The bottom was then flattened by re-striking in a sizing die.

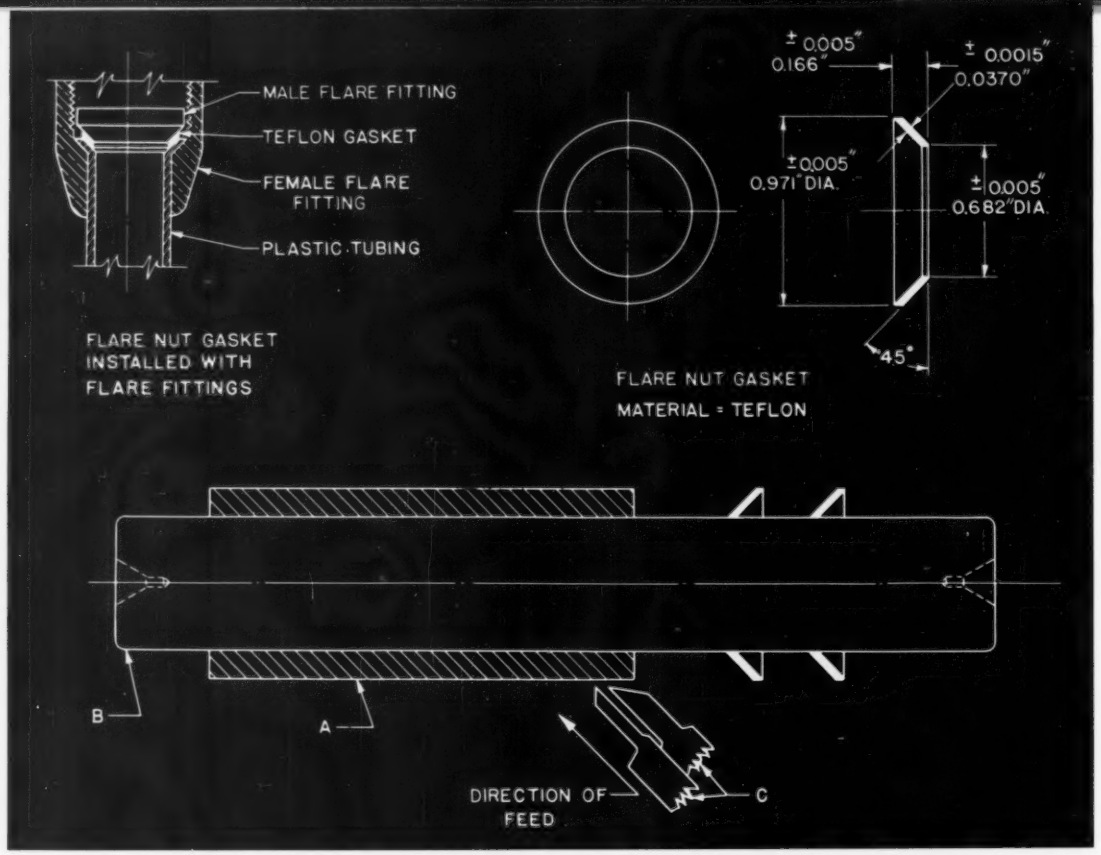
The common design for such second-operation dies is with the part inverted. It is easy to construct a die that will squeeze the bottom into correct shape and at the same time obtain the exact height for the two legs, with the work in this position. But with this type of die, ejecting becomes a problem since the squeezed work-piece tends to stick firmly in the die cavity.

An automatic knockout of a standard design failed. Since the part must be completely lifted from the die, it was quite difficult to find sufficient space for the long and heavy spring required to produce the necessary travel and high ejecting pressure. Also, the upper rest position of the ejector was too high to allow an easy introduction of the following work-piece into the proper position in the die.

A change-over from the spring-actuated ejector to one operated by the press ram, as illustrated, solved the problem. Here, knockout pin *A* is actuated by the pivoted horizontal lever *B*. On the upward stroke of the punch-holder *C*, the lever is engaged by latch *D*, which carries one end up until work-piece *E* is ejected. Just before reaching the highest position of the ram, the latch is disengaged from the lever by means of the tripper *F*. The ejector pin then retracts into the die, aided by a suitable spring *G*. This allows the next work-piece to be positioned in the die cavity with minimum effort.



Ejector pin (A) retracts fully to allow easy loading of die. Part as received for this sizing operation is shown at X.



Chevron type gaskets of uniform thickness are produced by feeding the tool bits (C) in the direction indicated. Plastic tubing is not split, as only a minimum sealing pressure is required.

Machining Chevron Type Teflon Gaskets

By A. PEARL, Argonne National Laboratory, Lemont, Ill.

One method of producing Teflon gaskets of the chevron type that require a uniform wall thickness is here illustrated. This requirement is important when these gaskets are installed in metal flare fittings used for connecting plastic tubing. The technique prevents splitting of the tubing, as only a moderate tightening pressure is necessary to create a seal with the fitting. Small quantities of gaskets are machined as follows:

Teflon rod *A* is first bored on a lathe to the required inside diameter, and a mandrel *B* is pressed into the resulting cylinder so as to extend from both ends. Then, with the mandrel held between a collet and the tailstock center, the outside diameter of the Teflon is turned. Two tool bits *C*, ground and positioned as shown, produce the gaskets with a series of cut-off operations made in the direction indicated.

Turret-Lathe Tool Pierces Thin-Walled Tubes

By WILLIAM MORSON, Birkdale, England

A piercing tool designed for use in a turret lathe cleanly pierces two square holes of different size in the walls of a light-gage, annealed brass tube. Cross-sections of the tool before and after the tube has been pierced are shown in views X and Y of the accompanying illustration. Only low piercing pressures are required because of the softness of the material, and the tool design proves effective on tubes having a wall thickness of 1/32 inch. As shown in view Z, hole *a* lies diagonally to the axis of the tube, while larger hole *b* is parallel.

The two holes are pierced simultaneously by punches *K*. These punches are pressed radially inward by beveled surface *N* of the bore of the housing *A* as it is advanced by the turret over sleeve *B*. The sleeve end-wall at the left is counterbored 1 inch deep to a diameter 0.004 to 0.005 inch above the outside diameter of tube *W*. Plug *AA*, ground on its larger diameter from 0.002 to 0.003 inch less than the bore of the tube, is a light press fit within the sleeve, and is restrained from turning by a Woodruff key *BB*.

Holding the plug against axial movement is

a hollow shaft *C* which is screwed over the threaded shank of the plug. At this end, the shaft has a hexagon head for locking purposes. On the diameter protruding from the housing shank, the shaft is threaded for lock-nuts *D*, and contains washer *E*.

The sleeve is free to slide within the bore of the housing, but is kept from rotating by set-screw *G* extending into slot *F*. A compression spring *H* keeps the sleeve in its maximum left-hand position when the tool is not operating.

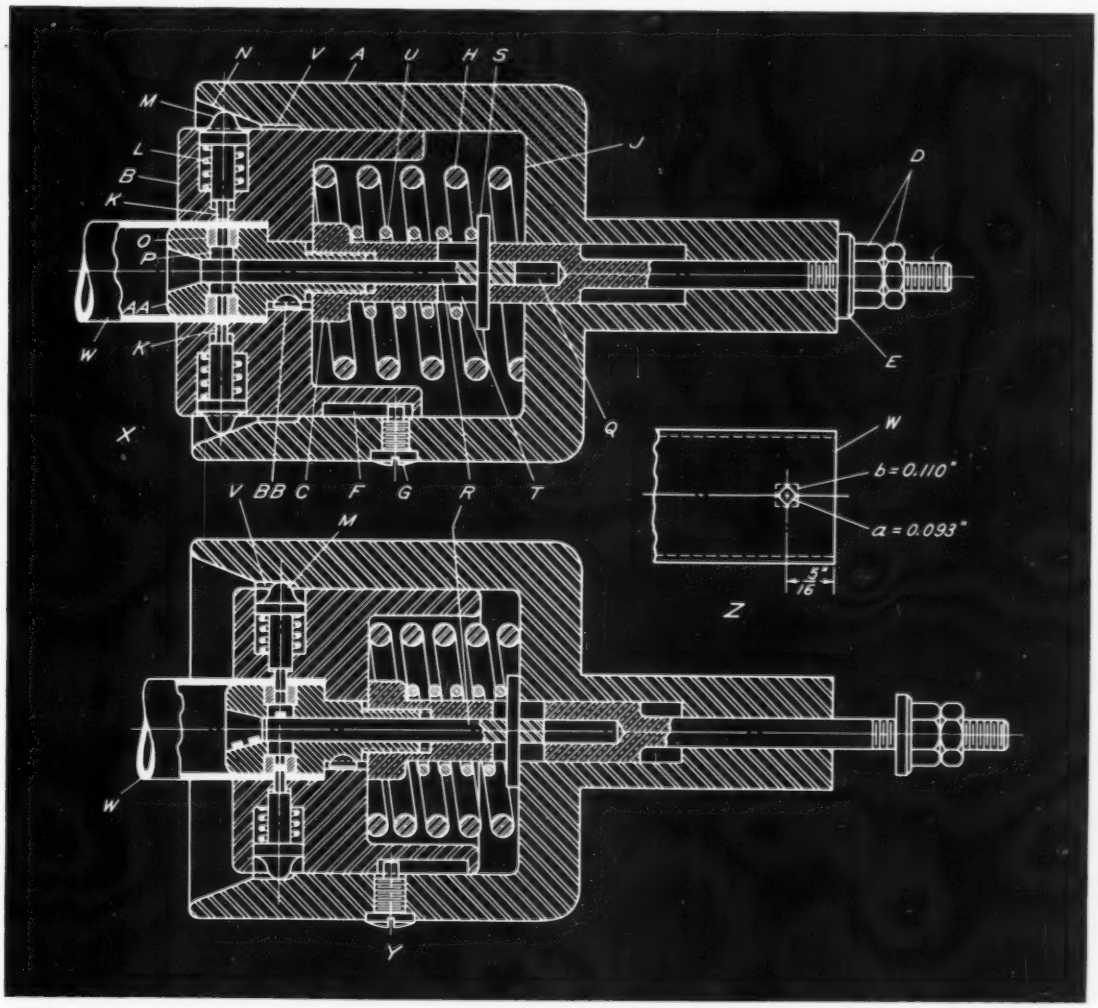
At that time, the punches are raised by the action of springs *L*. The outer end of each punch has a hardened dome *M* which bears uniformly against beveled surface *N*. To insure clean and accurate piercing, bushings *O* conform closely to the shape of their respective punches and are a press fit in counterbored holes on opposite sides of the plug. Punch slugs are pushed into holes *P*.

To eject the slugs, a blind hole *Q* is provided in the shaft, and rod *R* is fitted to slide within the blind hole and the bore of plug *AA*. Steel pin *S*, fixed across the rod, moves along slot *T* in shaft *C*. Coil spring *U* holds the rod normally retracted to the right. Thus, the rod moves in unison with the sleeve and the shaft for a certain distance.

In operation, the piercing tool is mounted in a face of the hexagon turret, with the punches preferably in a horizontal plane, to facilitate the ejection of slugs. When the bottom of the hole in the sleeve contacts the end of the tube, further advance of the turret causes the housing to slide to the left over the sleeve, and the punches move simultaneously through the tube walls. Slugs are pushed into the bore of the shaft.

While the punch domes are constrained by diameter *V*, the inner wall of the housing bears against pin *S*, making the rod move to the left to sweep out the slugs, as in view Y. Upon retraction of the turret, the various springs return the elements of the tool to their initial positions.

This turret-lathe tool punches two holes simultaneously near the end of a thin-walled tube.



Machine Tool Builders Addressed by Government Officials

THE annual spring meeting of the National Machine Tool Builders' Association, held at the Sheraton-Park Hotel, Washington, D. C., May 2 and 3, was highlighted by a series of talks given by outstanding officials of the Government. The Friday session was devoted to that portion of the program.

At the Thursday session, Jerome A. Raterman, president of the Monarch Machine Tool Co. and president of the National Machine Tool Builders' Association, pointed out that the industry is currently operating with a backlog of approximately five and one-half months and that shipments will probably continue at a high rate throughout the year, although they will probably taper off and may not reach the total of $886,150,000 attained last year. Incoming orders are not keeping pace with shipments but should exceed $725,000,000 for the year, which would be considerably higher than the total shipments of the industry in 1955. He was convinced that the long-term trend will be upward.

In referring to the fact that government relations would be the keynote of the meeting, Mr. Raterman stated that there were two considerations to keep in mind as to the Government. First—the United States Government is the largest owner of machine tools in the country and remains today, in peacetime, one of the industry's largest customers. Government relations are, in fact, customer relations. Second—every phase of the business of the machine tool industry, whether relating directly or indirectly to the production of machine tools, is affected by the laws, actions, and policies of the United States government. He pointed out that this is one of the reasons that the Government Relations Committee, Statistical Committee, and individual members have been working so closely with the people in Washington concerned with problems having a bearing on machine tools.

Another feature of the Thursday session was a lively panel discussion on the subject "Lower Costs through Coordination Between Engineering and Manufacturing." M. A. Hollengreen, president of the Landis Tool Co., was moderator, and other participants were Charles B. DeVlieg, president of the DeVlieg Machine Co.; Edward M. Dowd, executive vice-president of the Lapointe Machine Tool Co.; Harold S. Sizer, director of design—Machine Tool Division, Brown & Sharpe Mfg. Co.; and Harry C. Soukup, works manager of Giddings & Lewis Machine Tool Co.

In a report on Washington mobilization activities, Wallace E. Carroll, director, Metalworking Equipment Division, Business and Defense Services Administration, Department of Commerce, mentioned that the first phase of the cutting tool segment of the M-Day Machine Tool Trigger Program will contain ninety-one contracts, covering approximately 15,500 general-purpose machine tools of the most modern types having an acquisition value of about $334,000,000. The completion of this program has been delayed because of a six-month limitation clause in the Machine Tool Trigger Contract. This clause precludes from the program medium and slightly larger sizes of machine tools. To facilitate the completion of the first phase of the program, it was announced that machine tools requiring more than six months to complete would be eliminated from the ninety-one contracts. It is hoped that the first phase of the program will be completed by June 30.

Swan E. Bergstrom, chairman of the Government Relations Committee and executive vice-president of the Cincinnati Milling Machine Co., announced in his address that some progress has been made in the machine tool modernization program undertaken by the Armed Services. This is particularly true in the case of the Air Force and the Navy Bureau of Aeronautics. There are definite indications that modernization of existing government-owned facilities is planned and that old and obsolete equipment will be replaced. Although a formalized replacement manual has not yet been issued, it is understood that the Defense Department is working on such a manual, in order to give the various government-operated facilities, as well as the government-owned but privately operated facilities, a guide by which they can modernize their tool program.

Mr. Bergstrom also mentioned that the Government Relations Committee is working with the Treasury Department in the development of a new depreciation policy for machine tools. The Association counsel and a subcommittee are in the process of preparing statements to be presented before the Treasury Department with regard to the revision of Bulletin F of the Internal Revenue Code. The spiral of inflation has made Bulletin F completely out-of-date, according to

Mr. Bergstrom, and a new approach to the theory of depreciation is necessary in order to enable the machine tool industry to retain enough money to keep plants modern and in operation.

In his address "Growth—or Stagnation," Frederick H. Mueller, Assistant Secretary of Commerce for Domestic Affairs, pointed out that despite reduced prosperity in some branches of the national economy, the Council of Economic Advisers has reported that the gross national product hit a new annual rate of $427,000,000,000 for the first quarter, which is about $3,000,000,000 above the record of the fourth quarter last year. Present income, supported by high employment and rising wage rates, continued its record-smashing advance throughout the first quarter of this year, reaching an annual rate of $337,500,000,000 in March. This was $4,000,000,000 above the last quarter of 1956 and $19,000,000,000, or 6 per cent, over March a year ago. Mr. Mueller reminded his audience that the United States, with only about 6 per cent of the world's population, can produce and consume about 60 per cent of the world's goods. He paid tribute to the machine tool industry for having helped create our great productivity.

In his talk "Logistics and National Defense," Perkins McGuire, Assistant Secretary of Defense (Supply and Logistics), referred to the policies of his department with relation to military machine tools and other production equipment. He mentioned that their policies are intended to improve the military program and to avoid adverse effects on the machine tool industry.

In referring to the leasing policy, Mr. McGuire stated that the Department of Defense is not interested in leasing simply for revenue purposes. The intention is to keep the production equipment ready for military production, if and when needed. Leases are made in accordance with the provisions of the Armed Services Procurement Regulation—under terms that prevent unfair competition—and only after specific approval of each individual case by the Office of Defense Mobilization.

An extensive survey has been conducted to find out exactly what machine tools the military departments own. To date, about 280,000 machine tools costing more than $500 each have been inventoried. The total acquisition cost of these machines is about $3,000,000,000. The inventory is considered about 80 per cent completed.

The military departments have been directed to make plans for a definite replacement program of machine tools. Funds for that purpose have been requested in the fiscal year 1958 budget, which has been sent to Congress. The rate of replacement will undoubtedly be less than considerations of current production costs alone would dictate. However, if the funds are appropriated by Congress, progress in the right direction will be possible. Procedures have been set up for selecting old equipment to be replaced in a way that will insure the greatest possible return in reduced production costs.

In his talk "Opportunities for Small Business," Wendell B. Barnes, Administrator, Small Business Administration, emphasized the conviction in Washington that small business is of the greatest importance—that it is indeed the bulwark of our free enterprise, and in fostering the growth and progress of small business, competitive enterprise and the country's future are being immeasurably strengthened. His agency has three principal responsibilities: (1) to help small firms gain access to adequate credit on reasonable terms; (2) to help them obtain a fair share of the Government's orders and contracts; and (3) to assist them with their managerial and technical production problems. For the program of technical and management assistance, eighty-one Management Aids have been issued, each of which is directed at a specific management problem and designed to help the proprieter of a small firm to increase his knowledge. There have also been issued forty-eight leaflets called "Technical Aids" and nineteen, "Small Marketers Aids."

Russell C. Harrington, Commissioner of Internal Revenue, in his talk "The Administration of the Federal Tax Laws" conceded that the scientific, engineering and production developments of recent years had made it necessary to review the useful life tables of Bulletin F in the Internal Revenue Code. He mentioned the desirability of giving priority to the development of new regulations. An advisory group appointed to head up this study consists of outstanding engineering and accounting specialists, and includes representatives of industry, the Treasury Department, and the Internal Revenue Service.

John Baker Hollister, Director of the International Cooperation Administration, presented a clear picture of the use of funds that have been placed at the disposal of his agency. He asserted that practically all of the money is spent in the support of our national defense efforts. Only $200,000,000 or $300,000,000 out of more than $4,000,000,000 can be considered "give away."

Gordon Gray, Director of the Office of Defense Mobilization, mentioned that among the important programs of ODM are the M-Day pool and order program, the elephant tool program, the program for control of non-defense leasing, the central inventorying of idle equipment, the program for review of surplus equipment prior to sale, the review of government tool purchases from foreign sources, and the program for developing uniform leasing practices.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and

LeBlond Heavy-Duty Engine Lathe

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has recently announced a 20-inch heavy-duty engine lathe designed to employ the latest and toughest ceramic and carbide tools with maximum efficiency, applying up to 40 hp. Extremely short, heavy shafts and fine-pitch, precision-ground gears in the headstock deliver power to the spindle for heavy cuts but consume a minimum amount of power when running under no load. Ample power is also provided at low speed—for example, at 10 rpm, a cut can be taken as deep as 1/2 inch on work 16 inches in diameter with a feed of 0.063 inch per revolution.

This lathe has thirty-six speeds ranging from 10 to 1300 rpm in geometric progression. Speed selections are made in fine increments, particularly in the low range where a small variation or change in revolutions per minute makes a big difference in cutting speed and, hence, is an important factor in tool life. The forged spindle is supported in three places by five bearings.

The gearing in the two-speed tailstock provides conventional and low-speed spindle travel. When drilling, for example, the handle is pushed in to drill at a slow, powerful feed and is pulled out for quick retraction. The tailstock itself can be moved by power. Exclusive LeBlond worm-and-rack construction makes it possible to locate the handwheel at an angle convenient to the operator and provides exceptionally long travel and positive safety lock against thrust. Also, it provides full-length support of spindle—even when extended.

Controls have been especially designed for operator convenience, careful consideration being given to their shape, size and location. For example, to simplify changing speeds and feeds, the selection levers have been so arranged that they are always moved toward the operator to increase, and away from the operator, to decrease the speed or feed. Speed selection is also color-coded. Sensitive control of the spindle is by means of an electric clutch brake. Four-directional power rapid traverse is controlled by a single lever. In addition, there are: built-in horsepower

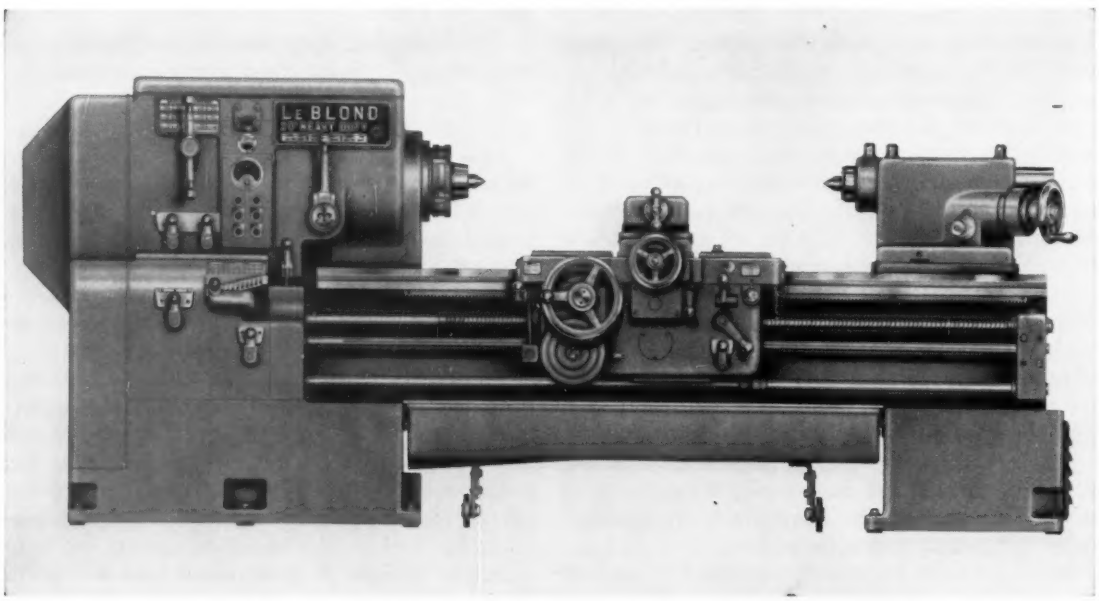


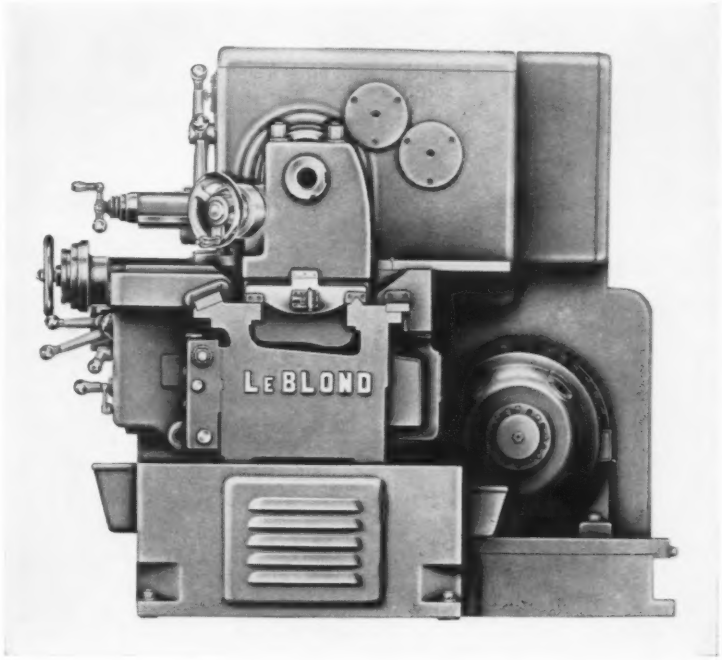
Fig. 1. Heavy-duty engine lathe developed by the R. K. LeBlond Machine Tool Co.

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

Fig. 2. Close-up of heavy-duty engine lathe shown in Fig. 1.



meter; chasing dial integral with apron; and quick-setting diameter reading dials on the cross-feed.

Other features of the new lathes include: hardened and ground replaceable steel bedways with compensating V-way design; automatic lubrication to head, quick-change gear-box and apron, with single-shot lubrication to tailstock; hardened and ground cross-feed screw with compensating nut; one-piece apron; flame-hardened rack; and total enclosure of quick-change gear-box.

This 20-inch lathe represents the latest addition to the LeBlond line of heavy-duty engine lathes which also includes: 12-, 14-, 16-, 25-, 32-, 40-, and 50-inch, as well as plain and sliding bed gap lathes in various swing sizes.

Circle Item 101 on postcard, page 229

Seneca Falls Loaders and Lathes Automated for Rear-Axle Shaft Processing

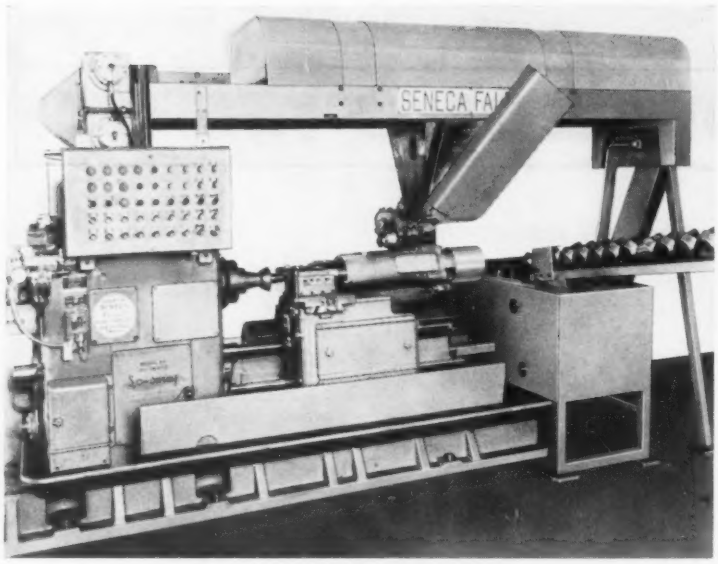
The Model VHM automatic loader and transfer mechanism, Fig. 1, developed by the Seneca Falls Machine Co., Seneca Falls, N. Y., is now available for the automation of new or existing lathes, grinders, or other machines that can be loaded from above and are designed to operate on an automatic cycle principle. Since all movements are purely mechanical, it can be installed and serviced under the direction of engineers who have no special knowledge of electronics. A 3-hp electric motor drives the loader through two clutch shafts.

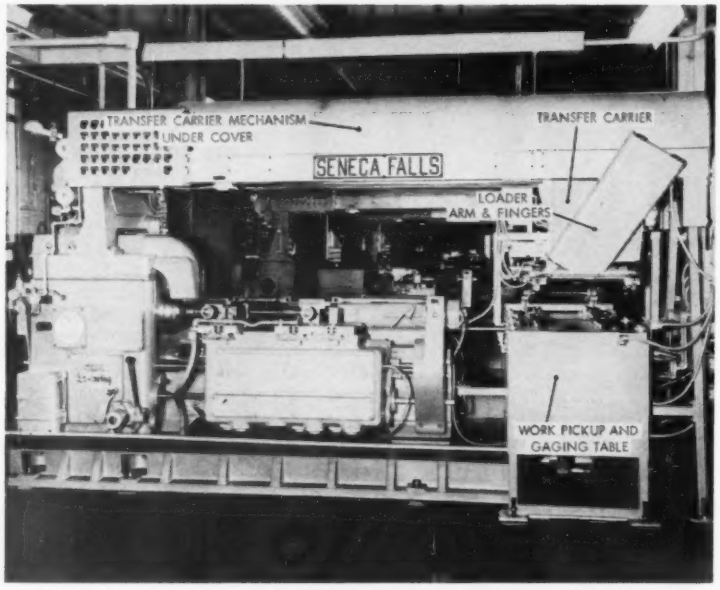
Four Model AR Lo-Swing lathes and loaders comprise the automated installation shown in Fig. 2, developed to process 180 rear-axle shafts per hour. Each lathe is complete with necessary tooling; automatic gaging station; work-transfer and work-loading equipment; conveyor lines; and mechanized chip conveyor and control panel for coordinating the movements of the loading and transfer equipment.

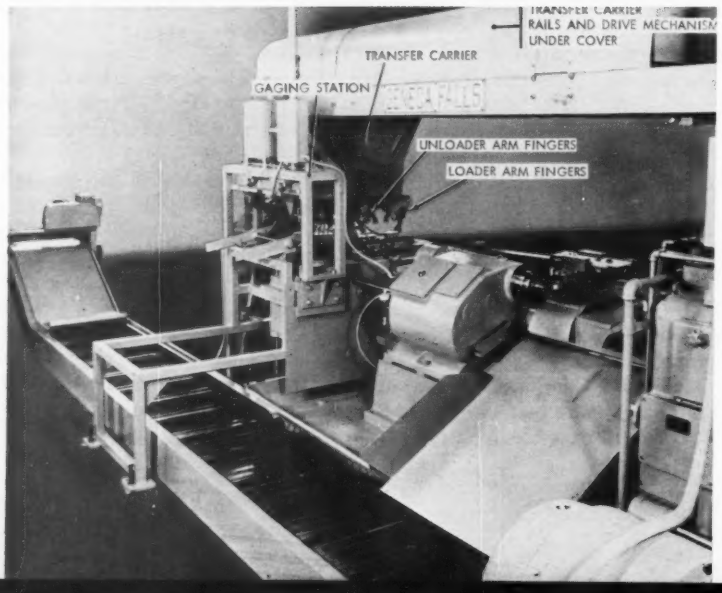
Fig. 2 shows the straight line layout of the lathes; the three lathes to the rear being visible through the center opening. Space is provided to permit the endless chain type conveyors to carry and store banks of parts between the machines, making it unnecesary to shut down more than one machine at a time for tooling replacement.

The axle shaft forgings arrive by chain conveyor (not shown) at the pick-up and gaging table of the first machine, Fig. 2. The rough parts are automatically dropped into shuttle cradles at the top of the work pick-up and gaging table. The shuttle cradles, mounted on endless chains, move forward in line with the elevator cradles, which are retracted to allow the shuttle cradles and the rough work-piece to pass over them to a position under the transfer carrier located over the pick-up table.

The rough shaft is then raised by the elevator cradles into the loader-arm fingers of the transfer carrier (also shown in Fig. 3)







which close on contact with the shaft. The transfer carrier then moves to the left to the loading position over the lathe. The unloader arms descend; the unloader fingers grasp the finished axle shaft; the tailstock center retracts; and the unloader arm returns to the retracted position. The loader arms with the rough shaft then descend to the center line; the tailstock center advances to support the shaft; the finger latch is tripped by the tailstock quill to release the fingers; and the loader arm returns to the relieved position. The headstock spindle clutch is then engaged, and the machining part of the cycle begins.

The transfer carrier now returns to the pick-up station, as shown in Fig. 2. The elevator cradles then rise and place a rough part in the loader fingers, as previously explained, while the unloader fingers are unlatched to release the finished shaft into the raised receiving elevator cradles. The finished shaft is then lowered into another set of shuttle cradles in line with the elevator cradles.

The finished shaft is raised from its shuttle by an elevator cradle and thrust into the gaging station, Fig. 3, which carries the necessary gaging heads. If all dimensions gaged are within the predetermined tolerances, the gage elevator cradle descends, and the finished part is released on spring-loaded swivel levers which guide the parts into a chain conveyor and to the next machine. While the preceding description covers the first machine only, the equipment furnished with the other three machines is identical with the exception of the actual cutting tools, tool-holders, and machine attachments which perform the machining operations.

Circle Item 102 on postcard, page 229

Fig. 1. (Upper) Seneca Falls loader and transfer mechanism

Fig. 2. (Center) Automated installation of four Lo-Swing lathes built by Seneca Falls Machine Co.

Fig. 3. (Lower) Rear view of lathe seen in Fig. 2, with "Chip Flow" bed and chip conveyor

Snyder segmented transfer machine that processes sliding-gear transmission cases

Snyder Special Segmented Transfer Machine for Processing Transmission Cases

A segmented transfer machine that utilizes work-orienting devices to avoid the need for vertical machining units and to provide maximum accessibility of tools has been built by the Snyder Tool & Engineering Co., Detroit, Mich. This fifty-three-station, 62-foot long machine drills, spot-faces, chamfers, reams, line-reams, taps, mills, and bores cast-iron sliding-gear transmission cases at a net production rate of eighty cases per hour. The cases are turned 90 degrees at the thirteenth station and tipped up 90 degrees at the thirty-eighth station.

Each of the thirteen segments of the hydraulically operated, electrically controlled machine is made up of horizontal two-way units of Snyder standard way type, self-contained design with hardened and ground ways. Separate push-button controls and panels are provided for each segment, thus permitting independent part-clamping, machining, and unclamping for setup and repair operations. To simplify tool changes, the spindles are arranged for pre-set cutting tools.

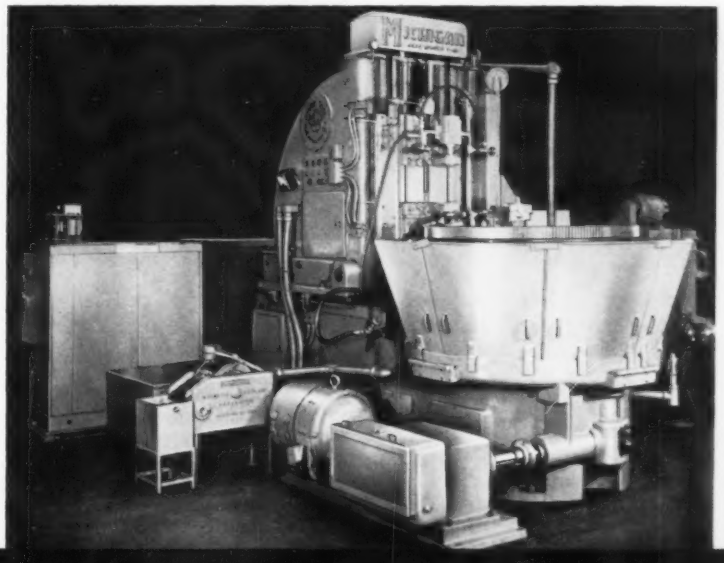
The master control panel has push-button controls and indicator lights that show the operating condition of each segment. JIC standard electrical and hydraulic controls are utilized throughout the machine. A fully automatic lubrication system is also provided.

Circle Item 103 on postcard, page 229

Michigan Vertical Gear-Shaving Machines

A line of redesigned and greatly improved vertical gear-shaving machines for precision finishing large gears has been announced by the Michigan Tool Co., Detroit, Mich. The first model of this line, the V-48, is especially suited for use in finishing gears for road-building equipment, turbines, and heavy machinery. It will accurately shave spur, spiral, or herring-

Improved gear-shaving machine announced by the Michigan Tool Co.



bone gears having pitch diameters as large as 4 feet and a surface finish of 12 to 15 micro-inches.

Two major improvements have been made in the machine drive section. The new cutter traverse drive is infinitely variable in a range from 0.034 to 0.188 inch per minute, using only two sets of change-gears. The improved work-drive also is infinitely variable in a range from 1.66 to 241.5 rpm.

Another important feature of the V-48 is the integrated checking fixture mounted on the machine column. It facilitates checking the gear being shaved for spiral pitch and concentricity. The spiral pitch checker is accurate within limits of plus or minus 0.0002 inch in 60 inches. The new model retains the transverse crossed-axis method of gear-shaving, with the cutter feeding into depth gradually and, at the same time, reciprocating across the gear face. Easier loading, angular-positioned instruments, centralized automatic lubrication, and properly grouped controls facilitate operation. The machine can be equipped with individually adjustable dual heads for simultaneously shaving with two cutters. This is particularly useful when shaving large herringbone gears.

Circle Item 104 on postcard, page 229

Ram Type Milling Machines

Two ram type milling machines have been developed by the Van Norman Machine Co., Springfield, Mass. They are: 38MA, Fig. 1, and 38MEA, Fig. 2. The adjustable cutter-heads used on these machines permit horizontal, vertical, and angular milling work to be done with one machine.

The machines have twelve spindle speeds ranging from 50 to 2000 rpm. The tables are 64 by 14 inches and have a cross-travel of 14 inches and a longitudinal travel of 34 inches. The table of the 38MA machine has a vertical travel of 22 1/4 inches and the 38MEA machine, 24 1/4 inches.

A 28A machine, not shown, is the latest milling machine in this new line. The latter machine is somewhat smaller than the ones illustrated. It has a table 58 by 13 inches. Spindle speeds range from 40 to 1600 r.p.m.

Circle Item 105 on postcard, page 229

DoALL Parallel Lapping Machine

Quick setup and easy operation are outstanding features of a parallel lapping machine developed by the DoALL Co., Des Plaines, Ill. This machine, together with lapping fluid or paste, work-holders, and monochromatic light inspection equipment—similar to that used by DoALL in producing precision gage-blocks—is now available to industry for the production of flat, parallel, dimensionally accurate surfaces.

Surface finishes of 0.09 micro-inch and dimensions held to one millionth of an inch are obtainable in production quantities with this machine. It is especially adapted for finishing small parts that are difficult to hold on a magnetic chuck or on centers for grinding, particularly thin parts subject to warping or damage during grinding. Nonmagnetic work which usually requires elaborate fixtures or time-consuming cement or wax holding methods can be readily handled. For work of this type, the lapping machine serves as an indispensa-

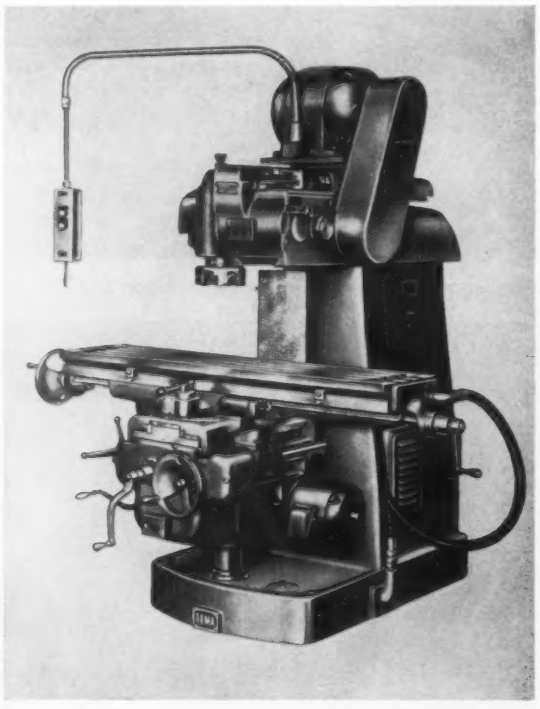


Fig. 1. Van Norman 38MA ram type milling machine

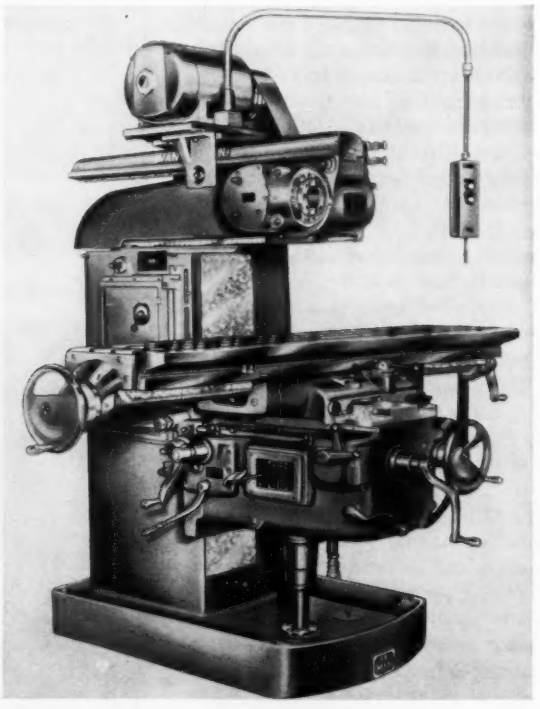


Fig. 2. Ram type Van Norman 38MEA milling machine

ble supplement to grinding for control of flatness, parallelism, roundness, and surface finish.

The drive provides infinitely variable speeds in either direction of from 10 to 50 rpm for either the lower lap or the work-holder. The speed, shown on a tachometer, reduces the cut-and-try approach which usually prevails in lapping. The wide speed range meets the requirements for lapping thin and fragile pieces of different materials having small surface areas, as well as for roughing large pieces, non-ferrous lapping, and conditioning the laps.

The lower lap is stationary, while the work-holder rotates for most flat lapping; however, for cylindrical lapping and for conditioning the laps, it is desirable to rotate the lower lap. This is quickly accomplished by simply engaging a pin in a socket.

The upper lap floats in a ball hanger which has four locking holes 90 degrees apart. It is held to the arm by means of a locking pin. This permits occasional rotation of the lap. A quarter turn of the upper lap made periodically, greatly prolongs lap flatness. Free rotation of upper lap for conditioning and cleaning is provided by merely withdrawing the locking pin.

The laps are of special stabilized alloy iron, 16 inches in diameter, with 4-inch faces, either plain or serrated. Mineral laps are available for non-ferrous materials. The laps may be quickly conditioned to the required degree of accuracy for the work to be lapped and are readily checked by means of a Monolight and optical flat. The machine will handle flat work 5 inches high by 5 inches wide by 5 inches long, and cylindrical work 5 inches in diameter by 5 inches long.

Circle Item 106 on postcard, page 229

Hydro-Cycle Contour Mills

A complete line of Hydro-Cycle contour mills is now available from the recently formed Colonial-Romulus Division of the Colonial Broach & Machine Co., Detroit, Mich. These hand-guided contour mills can handle a variety of jobs in large or small shops. They are available as either a complete machine or as a contour-milling unit for "building block" erection. Both types are designed and built to accurately contour-mill a broad range of metals.

Hand control of the tracer stylus attachment offers a true "feel" of the work so that irregular contours can be cut without complex equipment. In die work, the Hydro-Cycle eliminates expensive "barbering" operations. Tracer and template are offset for operator convenience and safety. Micrometer adjustments accurately control the desired relationship between master and work-piece. The tracer attachment can be furnished with single dimensional

Parallel lapping machine developed by the DoALL Co. for economical production of accurate flat surfaces

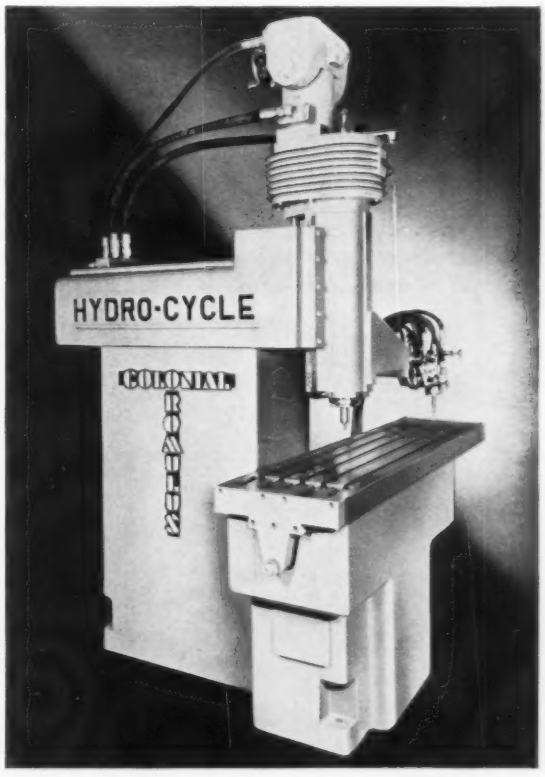


Fig. 1. Hydro-Cycle contour mill made by Colonial-Romulus Division, Colonial Broach & Machine Co.

(depth), two-dimensional (360 degree), or 3-D control.

The machine has an 18-inch cross-travel and a vertical travel of 12 inches. It is available in standard longitudinal travel lengths of 32, 42, and 48 inches; other dimensions and other travels can also be supplied. Spindle speeds are infinitely variable in a range of 40 to 3000 rpm. Full horsepower is available at all spindle speeds.

In the "Erector" model, the Hydro-Cycle is offered as a complete contour-milling unit for individual mounting or multiple setups on a common base. Fully equipped, the unit is basically the same as the complete machine but designed for lighter work. Cross-travels range from 12 to 36 inches with vertical travel of 8 inches. Longitudinal travel lengths are offered to suit the application.

Circle Item 107 on postcard, page 229

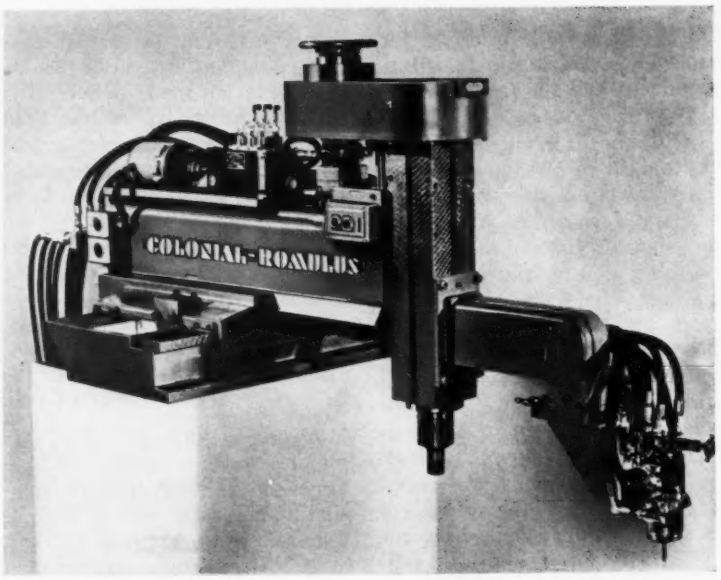


Fig. 2. "Erector" model of the Hydro-Cycle contour mill

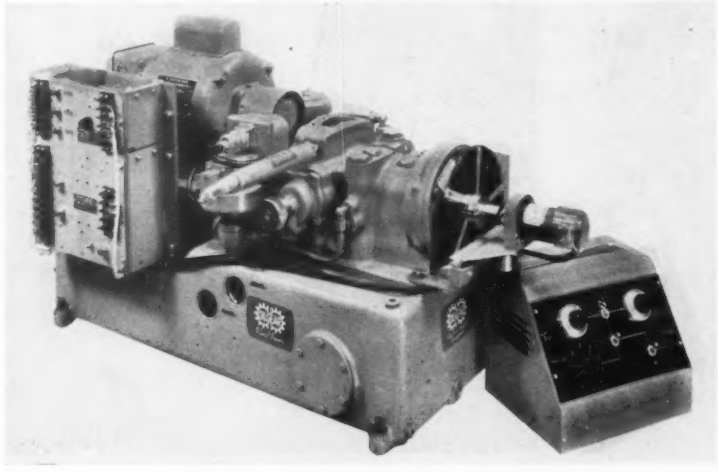
Electro-Hydraulic Servo-Controlled Drive

The Oilgear Co., Milwaukee, Wis., introduced an electro-hydraulic servo-controlled "Any-Speed" drive at the recent Design Engineering Show in New York City. Precision speed control from zero to maximum rpm and positive follow-up position control from a remote command unit were demonstrated.

Two speed dials and a selector switch on the command unit provided two speed selection functions. The dials of this unit can be set for two different speeds in one direction. Either speed can then be selected by a flip of the toggle switch. Dials may be set for any speed in one direction and another speed in the opposite direction. Reversal is then available instantaneously by a flip of the toggle switch. The dials may also be manually adjusted, resulting in stepless speed variation in either direction.

Instantaneous position control is available by merely flipping another toggle switch in the command unit. Any precise stopping positions can be dial-selected at will within the complete 360-degree range.

Circle Item 108 on postcard, page 229



Oilgear electro-hydraulic servo-controlled "Any-Speed" drive

Standard Inert Gas Welding Equipment for Cutting Non-Ferrous Metal Plate

The Aircomatic inert gas welding process, developed in 1948 by the Air Reduction Sales Co., a Division of Air Reduction Co., New York City, can now be used for cutting non-ferrous metals in addition to welding ferrous and non-ferrous metals. Using standard Aircomatic welding equipment, this new process requires no special operator techniques. Only simple adjustments in gas flow and steel wire speed are required. Both high production machine equipment and manual equipment can be adjusted for cutting with equal facility.

Aluminum, stainless steel, chrome steel, nickel, Monel, Inconel, copper, brass, and aluminum bronze have been cut with a quality entirely satisfactory for subsequent welding operations. On 1/4-inch plate, cutting speeds up to 132 inches per minute can be attained on aluminum, and 85 inches per minute on stainless steel. Cuts have also been made on titanium and magnesium.

Aircomatic welding uses a consumable wire electrode arc in an atmosphere of inert gas such as argon. The inert gas, introduced around the electrode wire, excludes all other atmospheric gases from the immediate area surrounding the electric arc and weld puddle.

In welding, the arc is maintained between the tip or end of the wire and the upper surface of the plate, while in cutting, the arc is maintained between the leading edge of the wire and the leading edge of the cut.

Circle Item 109 on postcard, page 229

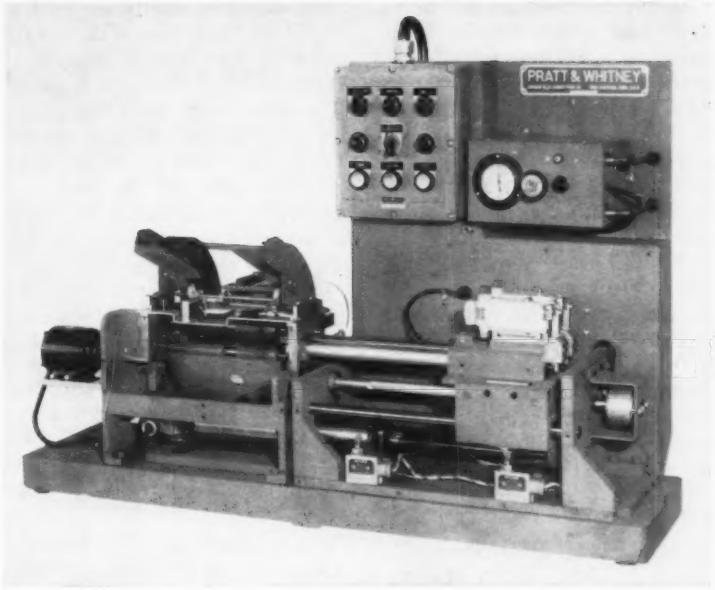
Axelson Heavy-Duty Lathe

A heavy-duty lathe designed to take rough or precision cuts with equal effectiveness is announced by the Axelson Mfg. Co., Los Angeles, Calif., a division of U. S. Industries, Inc. This 4025 lathe features a 75-hp headstock which will handle peak loads up to 100 hp and twenty-four spindle speeds in true geometric progression from 6 to 750 rpm. The swing over the bedways is 40 inches and over the cross-slide, 25 inches. A meter on the headstock enables the operator to determine the horsepower being consumed during the turning operation.

Two levers control feed changes on the totally enclosed gear-box. There are eighty-one feeds, ranging from 0.005 inch to 0.351 inch per spindle revolution, and 45 threads (from 1 to 30 per inch) can be cut. Longitudinal rapid traverse in either direction is controlled from the left side of the apron. Headstock control to start, stop, and reverse the spindle is on the right side of the apron, in addition to the controls at the headstock station.

The two-speed tailstock provides a fast rate of movement for bringing the tailstock center up to the work-piece as rapidly as possible, and a slow, powerful spindle movement for feeding drills, reamers, and other tools held in the center.

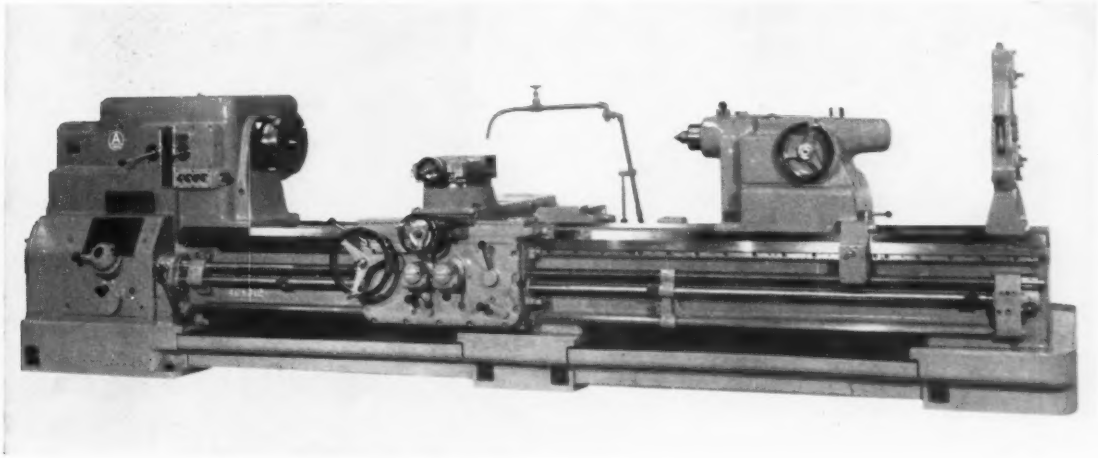
Circle Item 110 on postcard, page 229



Front inner view of Pratt & Whitney tube gaging unit with panels removed to show rollers and Sigmatic Microlimit gaging heads

Automatic Gaging Machine for Checking Thickness of Aluminum Tubes

An automatic gaging machine that checks the wall and bottom thickness of tubes and automatically separates them into good, rectifiable, and rejected categories at the rate of 1000 units per hour has been announced by the Pratt & Whitney Co., Inc., West Hartford, Conn. This machine will rapidly and automatically gage the diameter and wall thickness of all kinds of tubes.



Heavy-duty lathe announced by the Axelson Mfg. Co.

Aluminum tubes are fed into a chute from which they are transferred to a nest of rubber rolls rotating at approximately 600 rpm. As the tubes rotate, gaging contacts enter the open ends and measure the wall thickness along helical paths. At the end of the stroke or path, the bottom thickness is measured. After the gaging slides are retracted at faster-than-gaging speed, the contacts operate two Sigmatic Microlimit gage heads which sort the tubes into classification conveyors which discharge them into bins of usable, rectifiable, and rejected units.

Circle Item 111 on postcard, page 229

Zagar Small Drill Presses with Gearless Drill Heads

A line of small drill presses equipped with small-diameter, medium-duty gearless drill heads has been announced by Zagar, Inc., Cleveland, Ohio. The table, which holds the part to be drilled, is fed upward to the rotating drills at a predetermined rate. The upward travel of the table, feed to the drills, and return downward travel of the table are movements controlled by automatic cycling. The table, in this instance, carries an index fixture, so that twenty-five spindles drill twenty-five holes simultaneously in one pass, and fifty holes in two passes. The table is actuated by hydraulic control through a cylinder in the base.

The drill press is of small size (about 3 feet high). It has compact, self-contained operating mechanisms and is easy to adjust.

Circle Item 112 on postcard, page 229

Rotex Power-Operated Turret Punch

The Rotex Punch Co., Inc., San Leandro, Calif., has added to its line an 18-AH air hydraulically operated turret punch capable of punching a 2-inch hole in 12-gage mild steel or in 14-gage stainless steel. The turret has eighteen stations with punch sizes ranging from 5/32 inch to 2 inches, the smaller sizes being capable of punching heavier gage metal.

Rotex turret punch

Odd-shaped punch and die sets including square, rectangular, tube socket, and other types can be furnished for punching panels and chassis members.

Circle Item 113 on postcard, page 229

"Grind-Air-rester" Dust Collecting System

The Standard Electrical Tool Co., Cincinnati, Ohio, has recently completed its line of "Grind-

Small-size drill press with gearless drill head announced by Zagar, Inc.

Heavy-duty grinder with dust collecting system made by Standard Electrical Tool Co.

Air-rester" self-contained dust collecting systems with the addition of 7-, 8- and 10-inch sizes to their previously introduced 12- and 14-inch units. The sturdy cabinet base contains the dust collecting system assembled complete with the heavy-duty grinder.

The unit, as illustrated, arrests the grinding grit and dust at its source, thus protecting the worker's health and minimizing the exposure of the adjacent machinery to harmful grit and dust.

Circle Item 114 on postcard, page 229

South Bend Lathe Built Especially to Handle Long Work

A lathe designed especially for machining tubing, shafting, and other long work has been brought out by the South Bend Lathe Works, South Bend, Ind. This 16-inch by 14-foot lathe takes work up to 129 inches between centers. It has a swing over the cross-slide of 9 5/8 inches (11 1/8 inches without chip guard) and maximum diameter capacity over the bedways of 16 1/4 inches. Continuous X-bracing is used the entire length of the bed to provide extreme rigidity.

With a sixteen-speed drive, the spindle speeds range from 15 to 980 rpm. Motor and driving mechanism are enclosed in cabinet base under the headstock. The spindle hole takes work up to 1 3/8 inches, and the maximum collet capacity is 1 inch. Spindle can be supplied with threaded cam lock or with a long taper key drive nose.

A quick-change gear-box provides forty-eight thread-cutting feeds, forty-eight power longitudinal carriage feeds, and forty-eight power cross-feeds.

Accessories available for use with this lathe include pipe centers, steadyrest, follower rest, taper attachment, external and internal grinding attachments, collet equipment, coolant reservoir and pump, turret tool block, pneumatic bar feed, milling and keyway cutting attachment, and complete line of work chucks and tools.

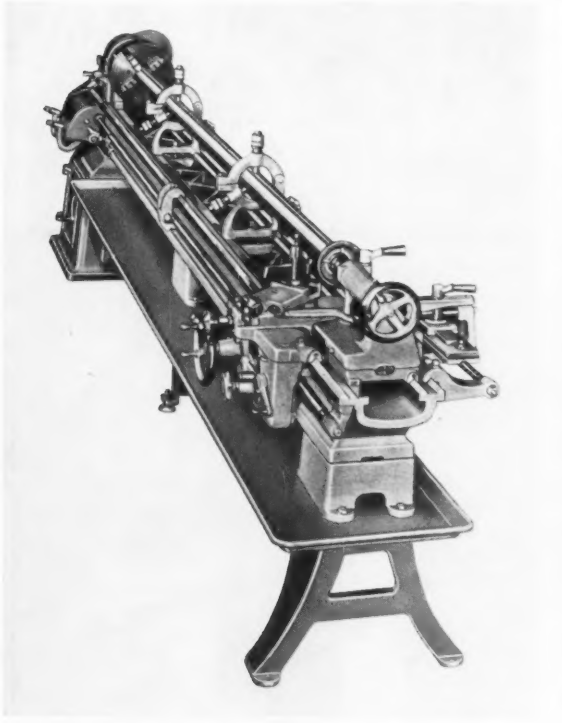
Circle Item 115 on postcard, page 229

Landmaco Single-Spindle Threading Machine

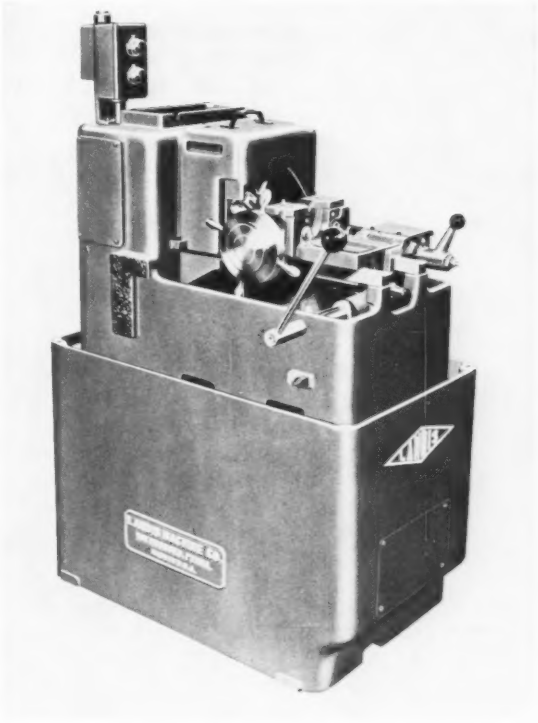
A 5C Landmaco single-spindle threading machine has recently been developed by the Landis Machine Co., Waynesboro, Pa., for the precision threading of small diameter work-pieces. This machine will produce threads to Class 3 and 4 tolerances on a production basis and has a No. 4 to 5/8-inch range. It is equipped with a 5VVV "Lanco" hardened and ground die-head, and can be furnished with or without lead-screw feed.

The head is equipped with Landis tangential chasers that can be ground for 80 per cent of their original length. An air-operated carriage front and carriage return, automatic or manual work stop, and a variety of special carriage fronts for holding difficult-to-grip work-pieces can be supplied.

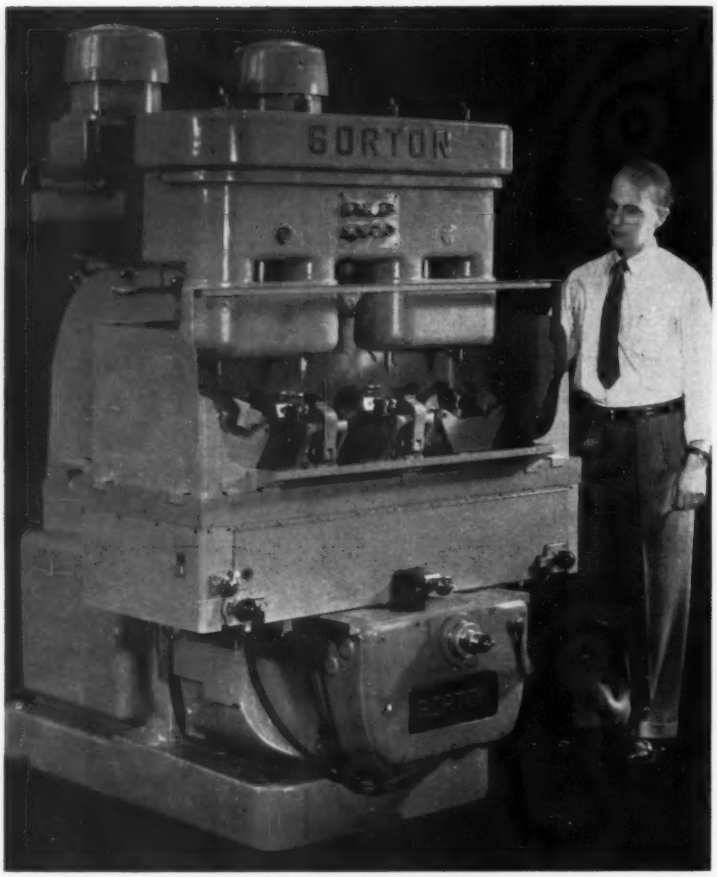
Eight spindle speeds, ranging from 150 to 1000 rpm, are provided by a geared headstock and four-step cone V-belt pulley drives. Higher or lower speeds



Lathe designed to machine tubing and shafting built by South Bend Lathe Works



Single-spindle Landmaco precision threading machine developed by Landis Machine Co.



Gorton four-spindle special-purpose milling machine

Four-Spindle Vertical Milling Machine

A special four-spindle vertical milling machine developed to mill two recesses in beveled gear blanks approximately 3 inches in diameter has been brought out by the George Gorton Machine Co., Racine, Wis. Production is limited only by the maximum speed with which the operator can unload and load two fixtures while two gears are being machined in the other two fixtures. Normally, production is at the rate of 200 pieces per hour. Infinitely variable feeds are available up to the capacity of available cutters. This machine was designed to permit the addition of three-dimensional hydraulic tracer control.

The spindles are belt-driven by two 2-hp motors; one motor for each pair of spindles. All movements of spindles, table, and rotating fixtures are hydraulically actuated with interlocked electrical controls for complete protection of cutters, work, and operator.

Four-flute, fast-spiral cutters are used, and approximately 150 parts are machined per cutter, after which the dulled ends are cut off and the cutters re-used. This is done twice so that 450 pieces per cutter are machined before the cutter is completely used up.

This machine was tooled for a

are available for special use. To enable rapid speed changes, a HI-LO shift mechanism is used. Replaceable hardened and ground ways with ample bearing surfaces minimize wear. A large chip compartment with a wide door provides for easy chip removal, and there is a drip ledge around the bed that returns the coolant overflow.

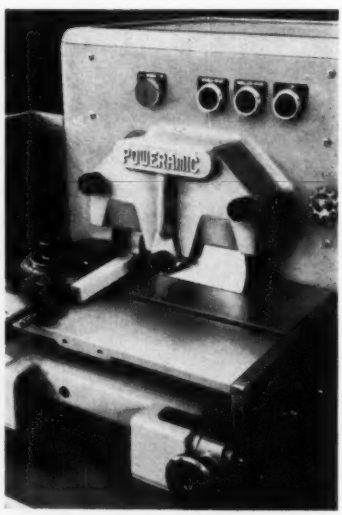
The carriage, operated by lever in conjunction with a toggle link, has a nominal 4 1/2-inch travel. However, total available thread length varies slightly with the carriage front, die-head chaser holders, and auxiliary equipment supplied. The lead-screw is easily changed to suit the pitch of the thread to be produced. The lead-screw nut segment, corresponding to the lead-screw being used, can also be quickly changed. The electrical control station is conveniently mounted on top of the headstock. Coolant, provided in a constant heavy flow, is filtered prior to passing through the pump.

Circle Item 116 on postcard, page 229

"Poweramic" Tool Grinder

An improved model of its "Poweramic" tool grinder has been announced by the Wesson Co., Detroit, Mich. This grinder is designed to enable an unskilled operator to produce hone-like finishes on cutting tools. Improved, more easily accessible controls serve to greatly reduce tool grinding time. A finer finish and greatly reduced diamond wheel costs are said to result from the "Tru-Arc" grinding principle embodied in the design of this grinder. Improved devices for setting the table and locating the tool for automatic, accurate grinding of correct tool angles are shown in the illustration.

Circle Item 117 on postcard, page 229



Wesson "Poweramic" tool grinder

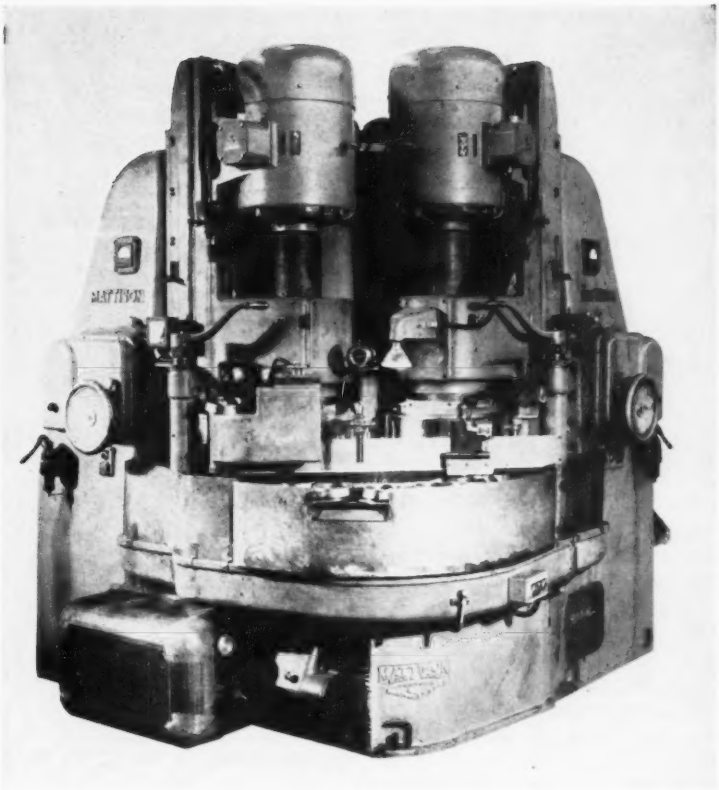


Fig. 1. Mattison grinder for machining automatic transmission clutch cones

maximum center line distance of 4 inches between recesses, but minor modifications make it possible to vary this distance considerably. Other variations are also possible.

Circle Item 118 on postcard, page 229

Adjustable Transfer Conveyor

An adjustable transfer conveyor designed to speed the movement of cylindrical in-process workpieces between machines has been developed by the Production Feeder Corporation, Mentor, Ohio. This Model No. 1000 conveyor mechanizes the removal and transfer of parts ranging from 1/8 inch to 1 9/16 inches in diameter. It can be easily installed and used with centerless grinders and other similar production machines and inspection equipment.

Each unit is completely packaged to include a chain belt conveyor, a drive motor, variable-speed transmission, and speed controls. The speed of the chain conveyor can be regulated between 5 to 20 feet per minute and the feeding of parts can be adjusted to suit production needs.

Circle Item 119 on postcard, page 229

Automatic Surface Grinder for Processing Clutch Cones

A rotary automatic surface grinder built by the Mattison Machine Works, Rockford, Ill., is turning out 385 finish-machined clutch cones per hour. The only operation performed manually in the entire setup of this No. 24-A2 grinder is the loading of work into the machine. From this point on, all functions, including unloading of the finished work, are performed by the machine.

Loading of the steel clutch cone by the operator does not require any special skill as only approximate positioning is necessary. The part is positioned and clamped for grinding when the clamping finger moves forward and holds the part against a notch on the inner ring of the work-table.

Typical of the numerous automatic safeguards built into the machine is the electrically operated switch on the grinding wheel that shuts down the machine if a part is improperly clamped. Thus, although clamping is fully automatic, there is no danger that a part improperly placed in the machine by an inattentive operator will damage the grinding wheel or itself.

From 0.010 to 0.015 inch of

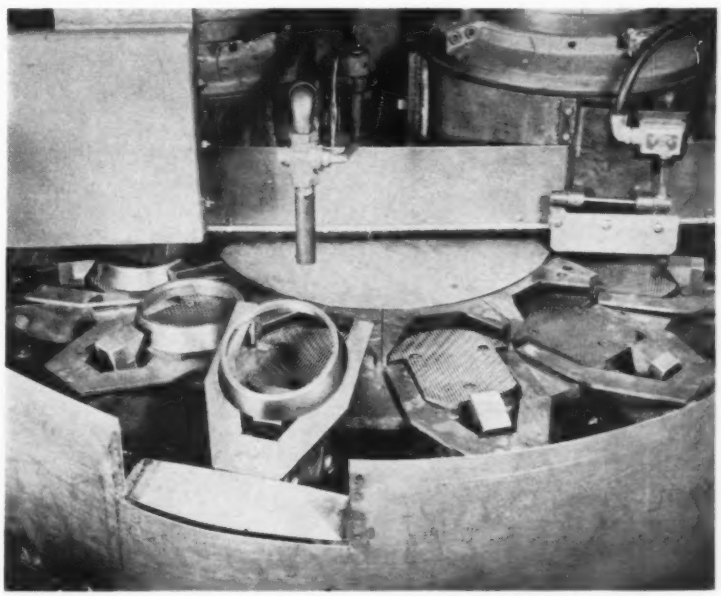


Fig. 2. Close-up of machine seen in Fig. 1, illustrating method of unloading work

stock is removed from one side of the work in a single pass through the machine. Automatic sizing is provided at both the roughing and finishing wheels. Additional limit switch protection is built into the machine, so that the automatic sizer ceases to function when the useful limit of the wheel is reached, and a red light flashes to warn the operator that it is time to change wheels.

Work is unloaded automatically after it has passed under the finishing head. A cam releases the part-holding clamp and the fork located below the work fixture tilts, as shown in Fig. 2, to slide the finished part into the chute.

Circle Item 120 on postcard, page 229

Automated System for Finish-Shaving, Washing and Gaging Cluster Gears

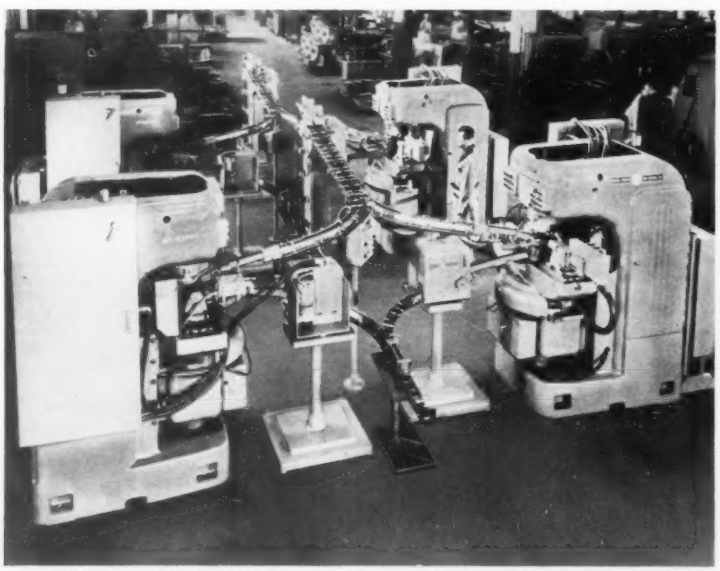
A simplified system that completely integrates the feed and controls of four individual Red Ring gear-shaving machines and provides for automatic washing and inspection of all finish-shaved gears has been developed by the National Broach & Machine Co., Detroit, Mich. This system is adaptable to a variety of cluster type gears having two or more gears on a part. It utilizes curved inclined feed chutes and motorized vertical chain conveyors that act as inter-machine storage devices.

Each of the four standard Model GCU Red Ring rotary gear shavers is equipped with a Red Ring rocker type automatic loader. Gears from each shaving machine are fed through the washers into motorized in-process gear checkers which automatically inspect the finish-shaved gears and reject from the feed chutes gears that do not meet gaging requirements.

The automatic gages can be equipped to shut down individual shaving machines after a predetermined number of rejects has been produced. In this event, the feed chute for that machine will start to fill up automatically. When this chute is full, the feed will automatically be shifted to the second machine, thus enabling departmental output to continue while one machine is shut down for tool changing or maintenance.

Individual push-button controls are provided for each machine, gage, and chain conveyor, thus, each unit can operate independently for setup or emergency purposes. If a third gear is included on the cluster, the automation system can be altered for this shaving requirement by adding another pair of shaving machines, a chute and chain conveyor feed, and a pair of motorized automatic gear checkers.

Circle Item 121 on postcard, page 229



Over-all view of automation system that integrates feed and control of four Red Ring gear-shaving machines, washers, and gages.

Model DBA-O belt type bench grinder

Abrasive Belt Bench Grinder

The Curtis Machine Division of the Carborundum Company, Jamestown, N. Y., has announced the addition of a Model DBA-O bench grinder to its line of abrasive belt machines. The 6-inch diameter, 2-inch wide contact wheel is driven by a 0.6-H.P. motor developing a speed of 5100 surface feet per minute. The direct drive of the contact wheel provides the speed required for quick, cool stock removal on applications such as grinding, polishing, and deburring. The idler arm incorporates belt tracking and tensioning mechanisms and can be rotated 360 degrees around the spindle to provide for operation in any position. The standard abrasive belt is 2 inches wide by 48 inches long.

For squaring, chamfering, and beveling, a platen attachment is available at a slight additional cost. This platen is attached directly to the idler arm and maintains its relationship to the abrasive belt without adjustment, regardless of the arm position.

Circle Item 122 on postcard, page 229

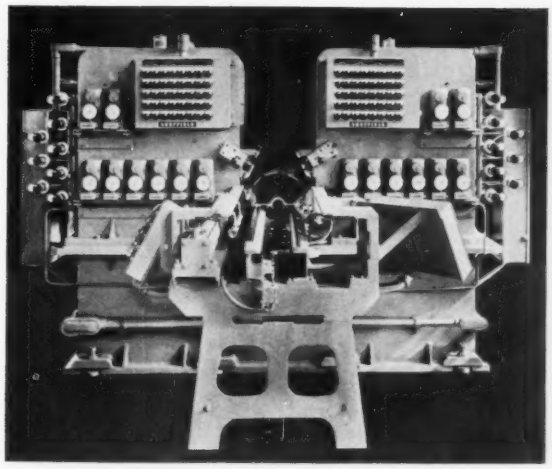


Fig. 1. Sheffield automatic gaging machine for checking valve-lifter holes

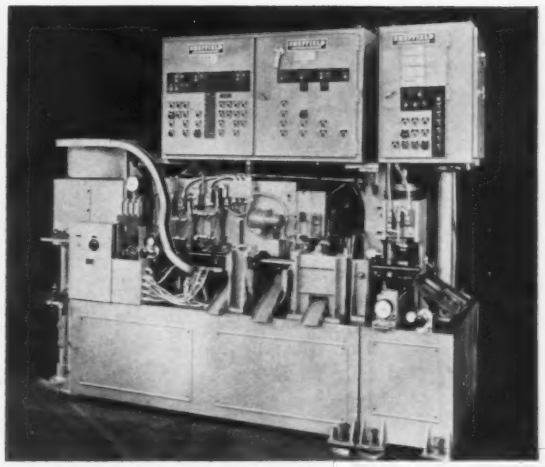


Fig. 2. Automatic assembling and inspecting machine for taper roller bearings

Sheffield Gaging and Assembling Equipment

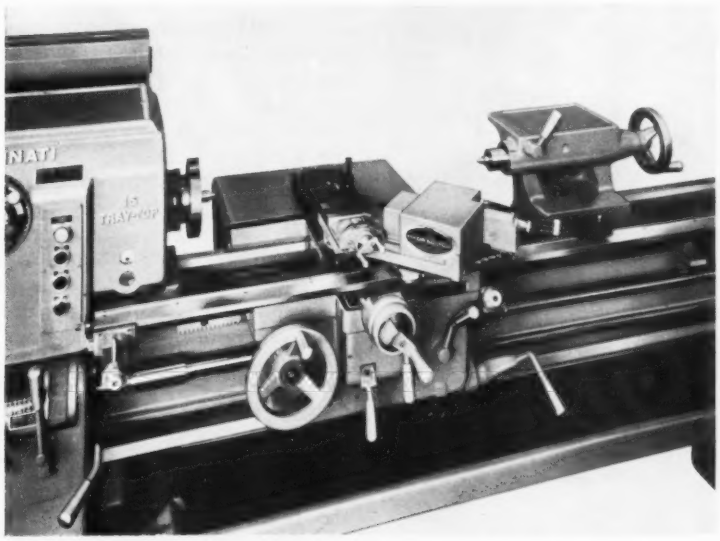
Sixteen valve-lifter holes in a V-8 engine block are checked for size simultaneously at two places on an automatic gaging machine, Fig. 1, developed by the Sheffield Corporation, Dayton, Ohio. This gage is located right in the production line. If bores are too large or too small, the gage feeds back signals that shut down the machine that produced the faulty dimension. The hole size, including the amount of out-of-tolerance, is visually indicated on its Sheffield "Lectrolair" unit.

Completely automatic assembly and inspection of taper roller bearings at a rate of 1000 bearings per hour is performed on the Sheffield progressive type assembly machine shown in Fig. 2. The machine gages the diameter and flange thickness of the inner race, selects the proper roller size, and assembles them with a cage. The assembled bearings are then gaged for torque and "standout" before leaving the machine.

Circle Item 123 on postcard, page 229

Cincinnati "Hydraguide" Tracer Lathe

A "Hydraguide" tracer lathe designed for automatic turning of multiple-diameter shafts and contoured work-pieces while retaining the versatility of a standard lathe, has been brought out by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. The tracer mechanism can be put into operation instantly by pressing a single push-button. When manual operation is desired, none of the tracer mechanism need be removed as it can be locked out of the operating position merely by retracting the tracer slide and pushing a single control button.



"Hydraguide" tracer lathe built by the Cincinnati Lathe & Tool Co.

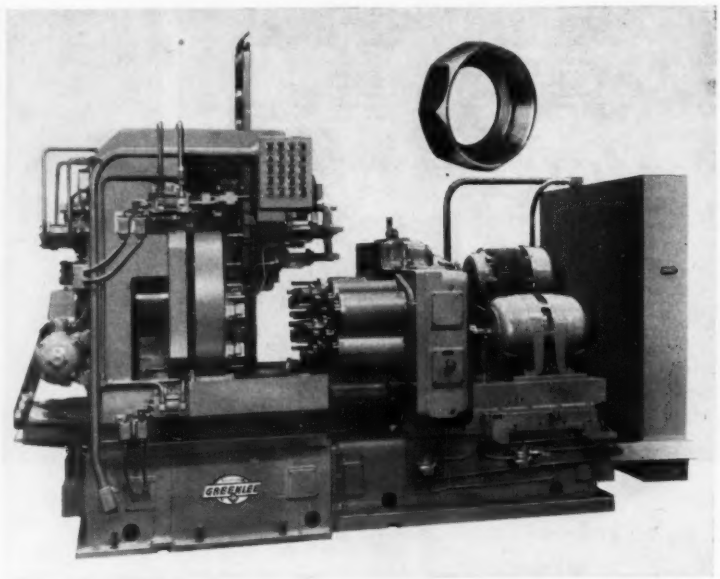
The entire unit is mounted on the carriage with all controls, template, tracer finger, and tools on the operating side of the lathe. This compact design requires no additional floor space, yet it does not interfere with standard lathe operations. In addition, it provides short hydraulic linkage, insuring maximum sensitivity in tracer control.

The "Hydraguide" will automatically turn multiple-diameter shafts, shoulders, tapers, necks, and contours. It can also be employed for many boring and facing operations. The all-hydraulic tracer control is extremely sensitive and will accurately reproduce the template shape without need for special operator skill. The

swiveling tracer is normally set at a 45-degree angle to the center line of the lathe. This permits the machining of square shoulders at high feed rates without interruption of lateral carriage movement.

"Hydraguide" tracer lathes are built in 15- and 18-inch swing sizes, and a wide variety of center distances from 30 to 114 inches. Motor size has been increased to 5 hp. There are twelve spindle speeds arranged in geometric progression from 37 to 1470 rpm. Any available speed can be instantly selected by three-lever, direct-reading, "color-match" dials. The forty-eight thread and feed changes afford a carriage feed range from 0.0019 to 0.1215 inch per spindle revolution, and a thread range of 1 1/2 to 92 threads per inch.

Circle Item 124 on postcard, page 229

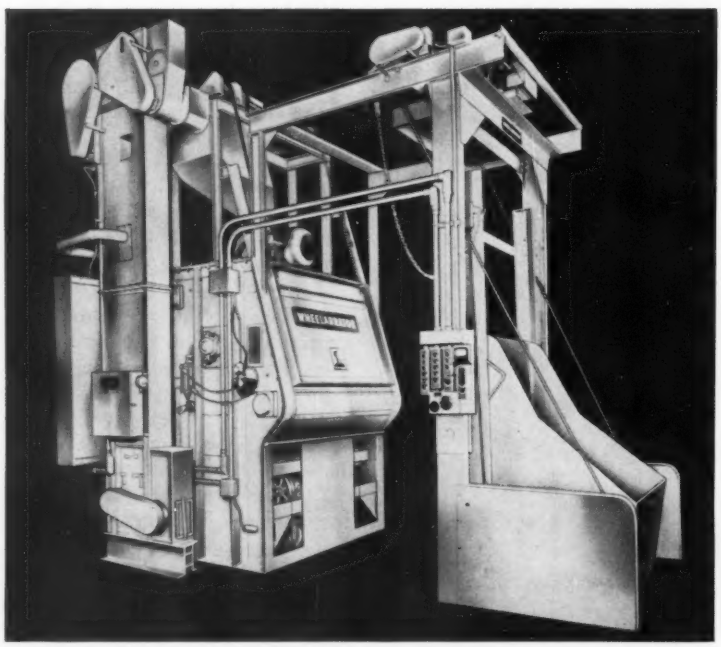


Greenlee indexing machine for processing pipe fittings

Airless Abrasive Blast Cleaning Machine

A new size of "Super Tumblast" airless abrasive blast cleaning machine for cleaning sand, scale, oxides, and other contaminants from metals has been introduced by the Wheelabrator Corporation, Mishawaka, Ind. This batch type machine, designed for work that can withstand a tumbling action, has an operating load capacity of 14 cubic feet. It can be operated automatically or manually. The abrasive-hurling wheel throws 830 pounds of abrasive per minute, spreading it over the cleaning chamber in a uniform manner.

Circle Item 125 on postcard, page 229



Over-all view of Wheelabrator "Super Tumblast" blast cleaning machine

Greenlee Horizontal Indexing Machine for Pipe Fittings

A one-way, five-station, horizontal automatic indexing machine has been designed and built by Greenlee Bros. & Co., Rockford, Ill., for high-production machining of malleable-iron pipe fittings. The parts are automatically loaded, four at a time, into the work-holding fixtures at Station 1 by a magazine type loading arrangement. They are then automatically indexed into the remaining four stations where the following machining operations are performed: two diameters are combination-bored, chamfered, and rough-counterbored in the second station, and a finish counterbore and chamfering operation is performed in the third station. Tapping is done at Station 4, and the parts automatically unloaded at Station 5.

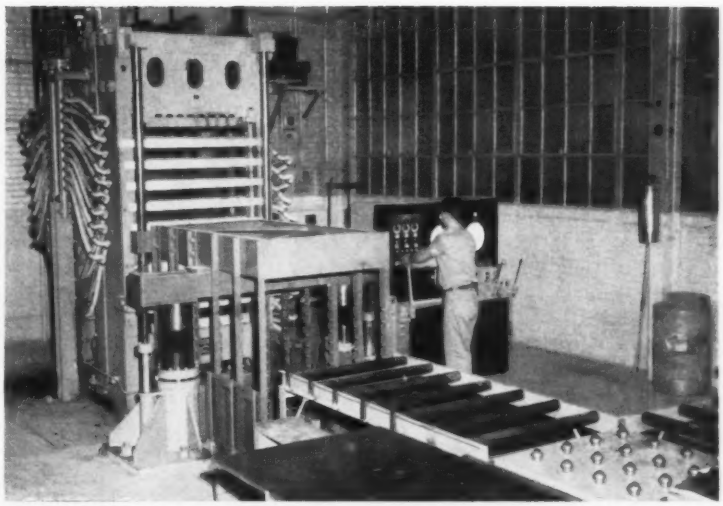
The machine is designed to handle a variety of five different sizes of pipe fittings ranging from 1 1/4-inch-12 thread to 2-inch-14 thread fittings at a gross production rate of between 576 to 712 pieces per hour, depending upon the size. To accommodate these different sizes, the machine is equipped with interchangeable clamping fixtures.

Circle Item 126 on postcard, page 229

Birdsboro Hydraulic Press for Laminating Large Plastic Sheets

The Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has built a large hydraulic press which will produce a laminated sheet 36 by 72 inches. This ten-opening platen press has side plates keyed and bolted to the main cylinder and top platen. A twenty-opening elevator attached to the front of the press permits loading every other opening during the pressing cycle, so that considerable time and handling are saved during the loading operation.

A complete load of ten "books" consisting of a number of plies or sheets of impregnated filler material is constantly ready for insertion in the new press as soon as the ten already in the press are ready for removal. The layers or plies of impregnated filler are converted in the press under heat and pressure to form a dense, solid sheet of laminated plastic material which is insoluble, infusible, and endowed with a combination of mechanical, electrical, and chemical characteristics not found in the original filler or resin materials from which the finished product is fabricated. Pressure is supplied for this operation by two 34-inch rams at 2500 psi.



Hydraulic laminating press built by Birdsboro Steel Foundry & Machine Co. for the production of large plastic sheets

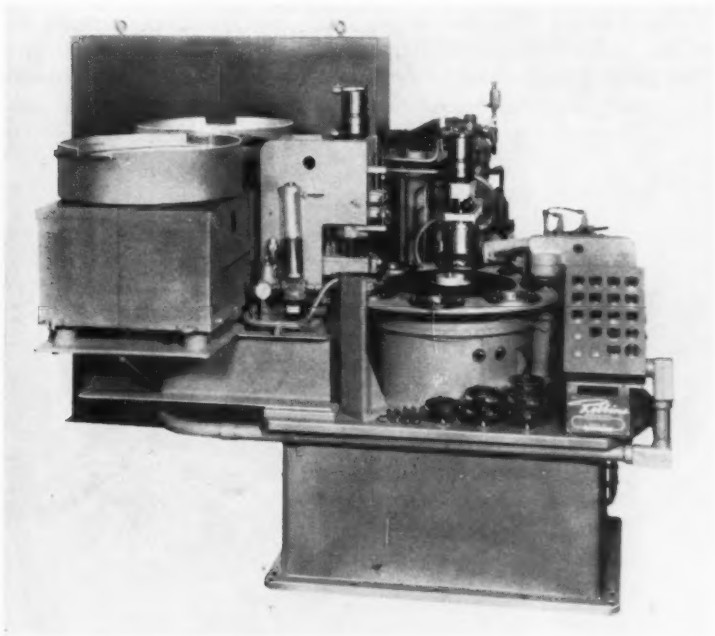
Circle Item 127 on postcard, page 229

Eight-Station Automatic Assembling Machine

An eight-station automatic assembling machine has been designed and built by the Omer E. Robbins Co., Detroit, Mich. This machine performs multiple operations including press-fit inspection on automatic transmission gear carrier assemblies. Four pinions with needle bearings and spacers for each are previously assembled into the gear carrier and held in place with dummy pins. These assemblies are manually loaded into the machine. At the first station, permanent pins are fed from two vibratory hoppers, shuttled into position, and pressed into the assembly, forcing out the dummy pins.

The next station checks the press fit of each pin, automatically informing a built-in memory circuit in the electrical system if a pin does not resist a predetermined pressure. This memory circuit causes defective assemblies to be ejected automatically at the next station. Acceptable assemblies continue without interference through this station to the next, where the pins are staked at each end to make a permanent assembly, thus completing automatically a series of operations previously requiring hand work.

All stations on the machine are hydraulically operated and have complete electrical interlock. Hydraulic and electrical equipment conforms to JIC standards. The machine is normally cycled to complete 720 assemblies per hour at 100 per cent efficiency with manual loading.



Machine built by Omer E. Robbins Co. for assembling and inspecting gear carriers

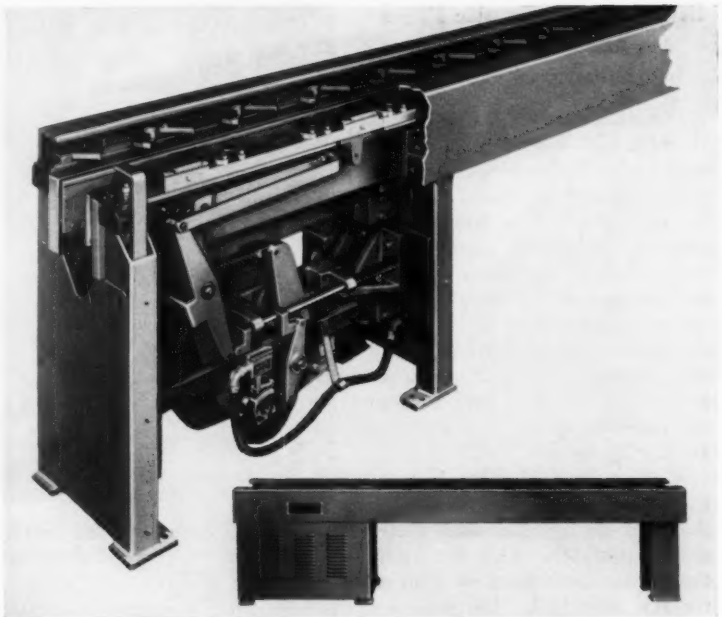
Circle Item 128 on postcard, page 229

In-Line Transfer Table

Dixon Automatic Tool, Inc., Rockford, Ill., is manufacturing an in-line transfer table without fixtures which will transfer parts or work-pieces from station to station for automatic or manual operations. This table can be adapted to multiple, consecutive operations and will handle 6400 pieces per hour. It is designed for parts which have a flat surface on which to slide along a track from station to station. The transfer table will cam lock the parts accurately at each station within a tolerance of 0.005 inch without auxiliary locating devices. When the tolerance is less than 0.005 inch, a pin or locating lug on the part can be utilized.

Index distance can be varied from 3 to 9 inches, and index time, from 0.25 to 0.7 seconds. Tables are regularly available in lengths from 5 to 12 feet, but longer tables can be furnished.

Circle Item 129 on postcard, page 229



Dixon in-line transfer table for automatic or manual operations

G-E Alternating-Current Induction Motors

The General Electric Co., Schenectady, N. Y., has announced a new line of alternating-current induction motors ranging from 40 to 125 hp. This line is built to the new NEMA standards, which assign a greater horsepower to a given motor frame size. For instance, the 445U frame has been increased from 75 to 125 hp. This re-rating program has been made possible by applying new developments in engineering, metallurgy, insulating materials, and production techniques.

The Tri-Clad 55 motor design in the higher horsepower frame sizes, 364U through 445U, includes a complete line of both open-dripproof and totally enclosed fan-cooled motors. The line also features substantial weight and space savings in addition to higher efficiency, quieter operation, improved performance, and reduced maintenance. The weight reduction, compared with the former line, averages 20 per cent. In general, the new models range from 100 to 500 pounds lighter in com-

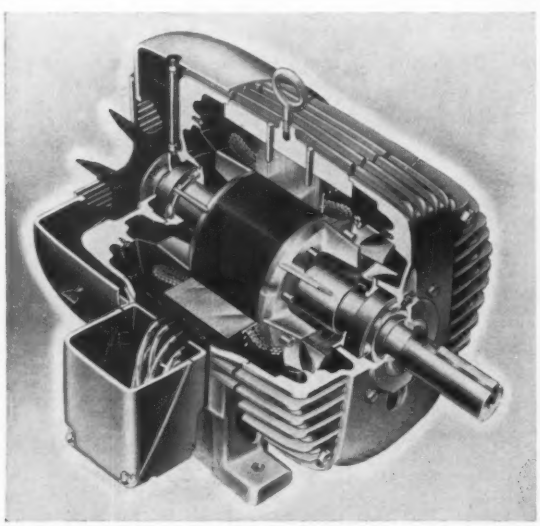


Fig. 1. Cut-away view of new General Electric totally enclosed fan-cooled motor

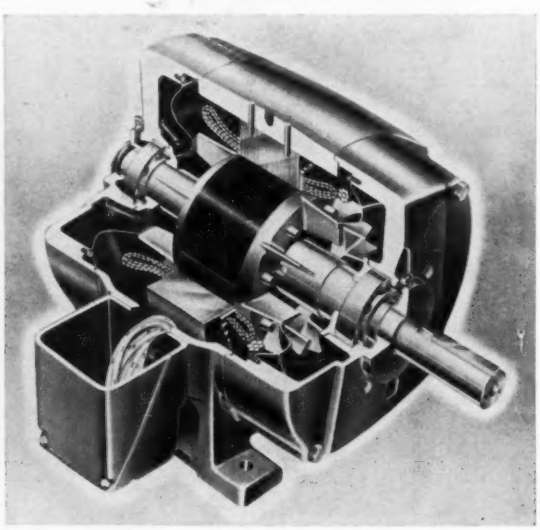


Fig. 2. General Electric open-dripproof motor cut-away to show improved design

parable ratings. Lineal dimensions have been reduced an average of 10 per cent, and volume, an average of 27 per cent. The weight and space savings have been achieved largely as a result of insulation improvements.

Centrifugal casting has reduced the porosity of the aluminum conductor in the rotor. Rotor slots have been completely closed to reduce motor noise, and air passages have also been designed for noise reduction. The panels are also non-resonating. Every motor is given a series of automatic tests for noise, vibration, and insulation. Assembly of the motors is accomplished automatically.

The cut-away view, Fig. 1, shows a totally enclosed fan-cooled motor in the new 40- to 125-hp motor line which has a specially designed fan cover that helps keep the air stream close to the motor surface. The external fan is of corrosion resistant and non-sparking Textolite plastic.

Fig. 2 is a cut-away view of an open-dripproof Tri-Clad 55 motor in the 40- to 125-hp range. Long, running seals along the shaft on the outside of the bearing housing serve to keep grease in and dirt out. The bearing housing and new synthesized greases are designed as a system to permit maximum intervals between regreasing. Oil leakage is prevented by a gasket between bearing cap and end shield housing.

Circle Item 130 on postcard, page 229

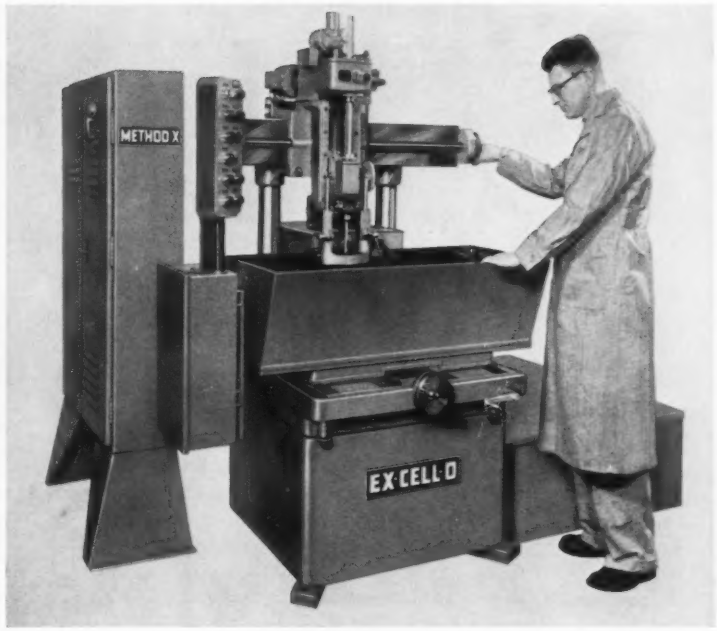


Fig. 1. Electrospark machine announced by the Ex-Cell-O Corporation

Ex-Cell-O Vertical Electrospark Machine

Carbide and other tough materials that cannot be machined by conventional methods can be handled by the Method X process on the Style 243-6 vertical electrospark machine introduced by the Ex-Cell-O Corporation, Detroit, Mich. This machine, Fig. 1, will pierce, drill, trepan, tap, or sink a cavity in any material that is an electrical conductor. It was originally designed to machine hard metals, form special shapes, or do similar work.

The machine is capable of positioning and holding the work, and feeding the tool to perform the desired operation by the electrospark process. The work-table is mounted on slides so that the work can be positioned under the tool. Because the cutting action of the Method X process creates no tool pressure on the part being machined, only sufficient clamping pressure is required to make a good electrical contact.

The Method X machine accomplishes metal removal by the utilization of a positive electrode, or work-piece, and a negative electrode, or tool, energized by a high-amperage electrical current. In this electromechanical process, electrical impulses pass between the tool and work, which are submerged in a dielectric bath. When the tool and work are brought in close proximity, controlled impulses remove particles of the work to form an inverse image of the tool. At no time does the tool actually touch the work. The particles acted upon are ejected and washed away by the circulating fluid, leaving tiny crater-like depressions in the work, which is characteristic of electrospark machining. The cycle is repeated many times per second, with each successive electrical discharge producing a crater, until these blend into a nearly smooth finished form. The resulting surface possesses a uniform matte type finish.

In addition to machining hard materials such as carbides, the machine will cut a variety of regular and irregular shapes such as shown in Fig. 2. Tools can be made from low-cost sheet brass, tubing, or rod. Steel may also be used.

Circle Item 131 on postcard, page 229

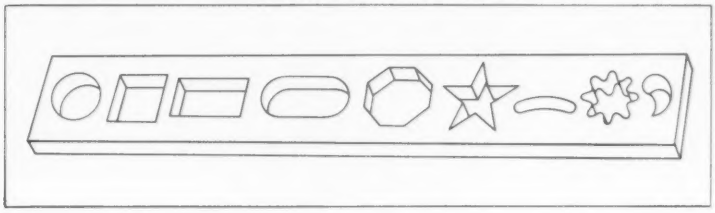
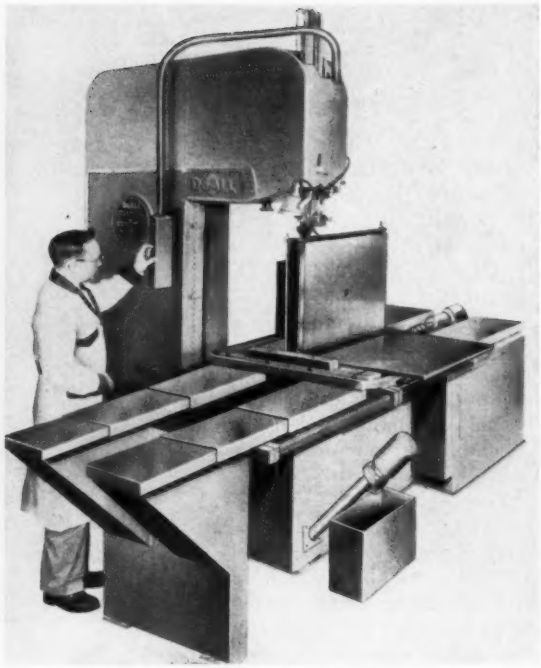


Fig. 2. Examples of irregular shapes cut by machine shown in Fig. 1

Burr-Master two-station machine developed by the Modern Industrial Engineering Co.



Band mill for heavy slicing and cutting operations announced by the DoALL Co.

Burr-Master for Chamfering Hidden Holes in Automotive Part

A special two-station Burr-Master for chamfering hidden holes in an automatic transmission part is announced by the Modern Industrial Engineering Co., Detroit, Mich. The work-holding fixtures used on this machine are custom-made, but the machine itself—employing the patented Burr-Master cutting principle—is adaptable to the processing of many similar automotive and aircraft parts.

The machine illustrated is set up for countersinking twenty blind holes on the internal diameter of a stator blade piston for an automatic transmission. The parts are semi-automatically positioned on the work-spindle, wedged, and then manually clamped. Central and radial locations for the work-piece are taken from pre-drilled holes. The rotary burr tool, mounted on a slender but sturdy shaft, is fed to the work at an angle of 90 degrees. The piece is automatically indexed for the complete work cycle.

The production rate for both stations is 200 parts an hour, whereas formerly, requiring five people, only 400 parts a day were turned out. An electric clutch stops the machine with both cutters withdrawn for loading and unloading. Separate motors and controls are supplied for each work-station for maximum flexibility.

The machine is equipped with upper and lower cam-actuated rocker tool assemblies; and a precision, ball-bearing, intermittent indexing assembly with provision for radial adjustment of pilot gear for work location. It has a totally enclosed, ball-bearing-mounted V-belt drive. All electrical circuits are made to JIC standards.

Circle Item 132 on postcard, page 229

DoALL Band Mill for Heavy Metal Slicing and Cutting Operations

A heavy, rigid Model 26-5 band mill designed to utilize the full cutting capacity of a 2-inch wide Demon high-speed steel saw blade has been announced by the DoALL Co., Des Plaines, Ill. The blade, when used with the hydraulic band tension and positive ball screw feed, makes possible the precision band machining of extremely large and tough work-pieces. The throat depth of the band mill is 26 inches; the work thickness capacity, 18 inches; and the band velocity ranges from 50 to 10,000 inches per minute.

The table will support work weighing several tons, yet it can be easily moved. Feeding rates as low as 0.100 inch per minute assure smooth, positive movements. A fluid drive, ball screw feed is utilized for these extremely slow feeding rates. The massive hardened and ground lead-screw is turned by a hydraulic motor.

Hydraulic cylinders provide for fast forward and quick return movements of the work-table. The rapid traverse is also variable and can be used in feeding fast-cutting materials such as aluminum. The minimum feed rate using the screw feed is 0.100 inch per minute, while the maximum feed using the rapid traverse is 10 feet per minute.

The motive power is provided by a central hydraulic system, but

the flow valves are of the solenoid type. This permits very flexible and effortless control from a central station.

Circle Item 133 on postcard, page 229

Single-Station Precision Finishing Machine

A new series of single-station precision finishing machines has been designed and built by the Hoern & Dilts Division of the New Britain Machine Co., Saginaw, Mich., to perform the following operations: contour-turning, boring, and facing; straight boring; surface grinding; surface honing; internal grinding; cylindrical grinding; contour-milling; and horizontal or straight milling.

Designed for jobs requiring rough or precision finishing operations, these BL-1 series machines utilize the standardized, cam-actuated heads developed for the Hoern & Dilts multi-station finishing machines. The application of these interchangeable heads to a single-station machine makes available completely automatic cycles of operation heretofore available only on the manufacturer's multi-station, high-production models.

The BL-1 series is available in single- or double-spindle models and with single-, multiple-, or variable-spindle speed drives. Motor drives from 3 to 20 hp per spindle are available. Cross-slide travel is 5 inches and longitudinal-slide travel, 6 inches. Other features are: rapid slide traverse during idle time; vertical spindles for easy loading and more accurate seating of parts in chuck; wide open, easily accessible tool area; large chip space; and optional high lift slides for loading of extra-large pieces.

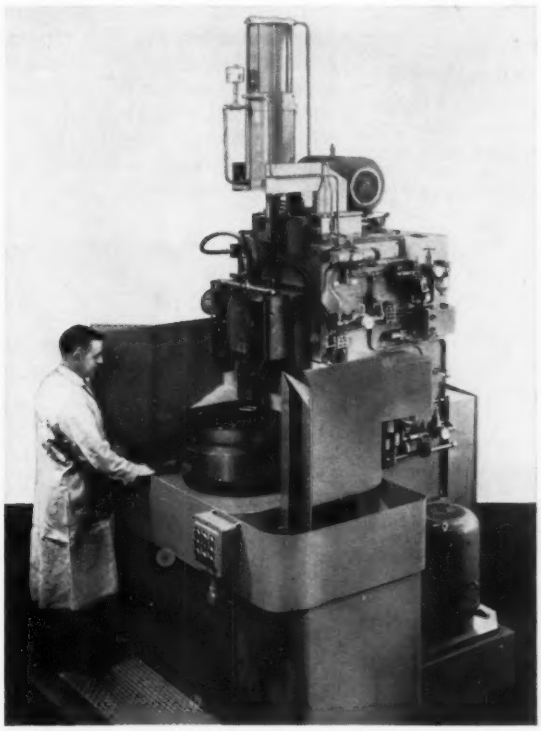
Circle Item 134 on postcard, page 229

Versatile Ultrasonic Amplifier-Generator

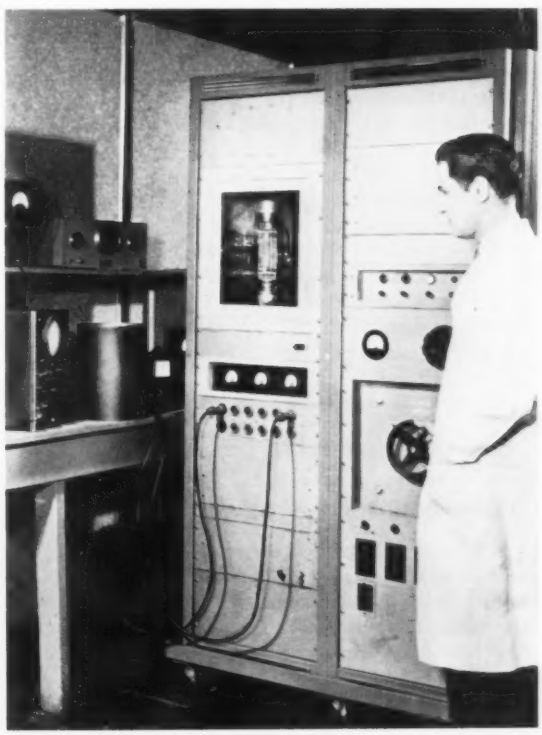
A versatile ultrasonic amplifier-generator, capable of producing 1500 watts, has been developed by Designers for Industry, Inc., Cleveland, Ohio. This generator is intended for production work and laboratory testing operations, including cleaning materials, thickness testing, drilling and grinding, cold welding, viscosity measurement, particle precipitation, electroplating, chemical processing, and particle size control. The generator, called the "Vari-Sonic," was developed for the company's own use to provide high power, continuous variability over a wide frequency range, and excellent adaptability for diversified applications. Due to the unique design of the output stage, excellent results are possible even though the transducer and the power supply are not matched perfectly. The equipment has been designed to protect itself and the transducer from damage caused by either improper techniques or unexpected overloads. The Vari-Sonic principle will also permit relatively efficient transfer of energy in any process in which the load imposed on the transducer is extremely variable.

This new equipment can be operated by nontechnical personnel and will prove useful for product testing and technical research.

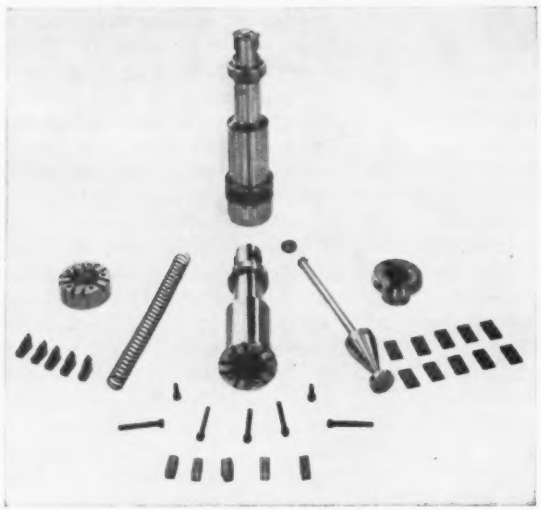
Circle Item 135 on postcard, page 229



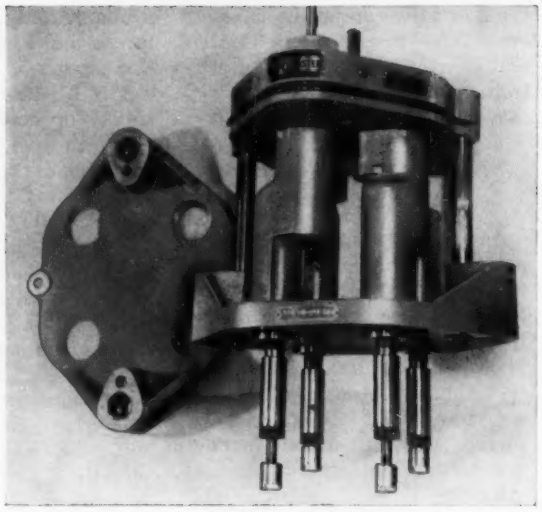
Precision finishing machine built by Hoern & Dilts Division, New Britain Machine Co.



Ultrasonic amplifier-generator developed by Designers for Industry, Inc.



Quick-loading, high-production honing tool developed by Barnes Drill Co.



Multiple-spindle tapping head developed by the Thriftmaster Products Corporation

Quick-Loading Honing Tool

Hardened steel inserts are used in a new quick-loading, high-production honing tool brought out by the Barnes Drill Co., Rockford, Ill. The inserts reduce wear and thus increase the life of the plate type tool. The illustration shows the relatively simple construction and few number of parts required. Also shown is the wing type honing stone used by these tools. This stone is manufactured by placing the abrasive in a trough-like form of plastic-impregnated kraft paper.

The range of the plate type tool is limited from 1 1/2 inches minimum to 5 inches maximum inside diameter. Stone lengths are limited from 3 inches minimum to 5 inches maximum. This tool was originally developed for honing connecting rods.

Circle Item 136 on postcard, page 229

Magnetic Roller Channels for Guiding Sheet Steel to Back-Gage of Power Shear

A line of magnetic roller channels designed to expedite shearing of light- and medium-weight sheet steel as heavy as 14 gage is announced by the Magni-Power Co., Wooster, Ohio. The roller channels are easily installed on any shear behind the breast and above the back-gage, as shown in the accompanying illustration. As the sheet to be cut is fed through the shear, the magnetic rollers seize and guide it into position against the back-gage. The magnetic rollers, turning free in the channels, are said to offer no resistance to the movement of the sheet. Actuation of the shear peels the sheet off the magnetic rollers and allows the sheared material to drop free.

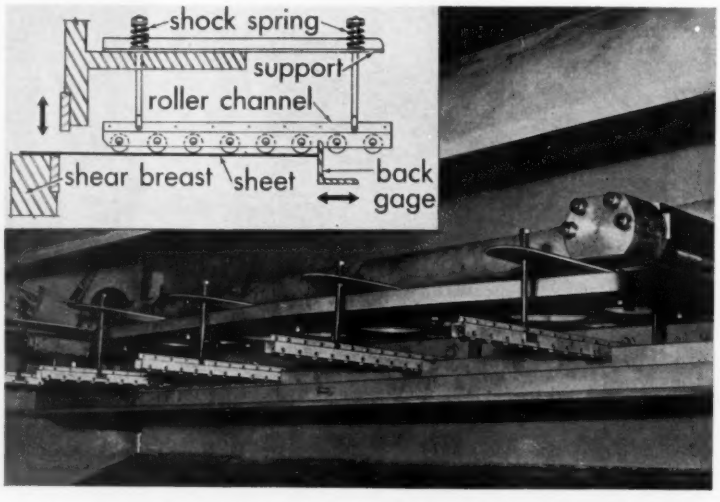
Roller channel assemblies are offered in standard lengths of 24, 36, or 48 inches. Optional lengths, in 2-inch increments, also are available on special order.

Circle Item 137 on postcard, page 229

Multiple-Spindle Head with Lead-Screw Tapping Spindles

Multiple lead-screw tapping of several parts with similar but varied hole patterns can be done with an adjustable multiple-spindle head developed by the Thriftmaster Products Corporation, Lancaster, Pa. This tapping head consists of a standard Thriftmaster ball-bearing double-eccentric adjustable drill head fitted with lead-screw spindles. Bronze lead-screw nuts built into the

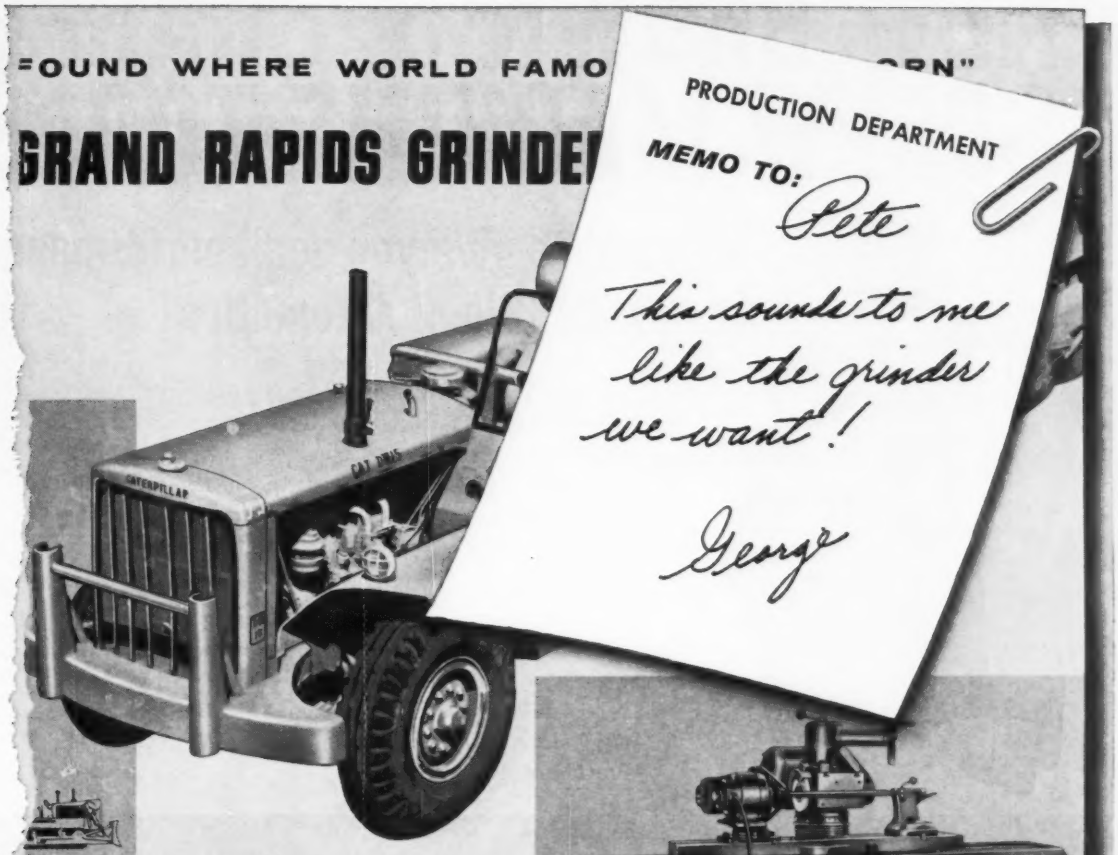
(*Continued on page 226*)



Magnetic roller channels made by Magni-Power Co. to hold sheet steel up against back-gage of shear to facilitate shearing

FOUND WHERE WORLD FAMO ... ORN"

GRAND RAPIDS GRINDE



Grand Rapids Universal Tool and Cutter Grinder, No. 62

- Wheel head moves to work—not work to head—for extra rigidity and convenience
- Fully guarded, anti-friction ball bearing ways
- Extra long table for greater work capacity
- Universal positioning of elevating hand wheel
- Four speed spindle drive
- Convenient one-shot lubrication system

These features sound particularly outstanding

ALLIS-CHALMERS

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Grand Rapids, Michigan

Write for details **GALLMEYER & LIVINGSTON CO.,** 305 Straight Ave., S.W., Grand Rapids, Michigan

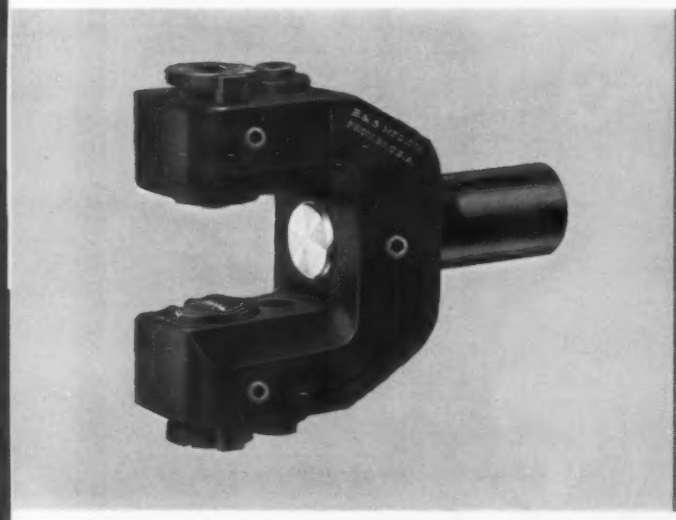
For more information fill in page number on Inquiry Card, on page 229

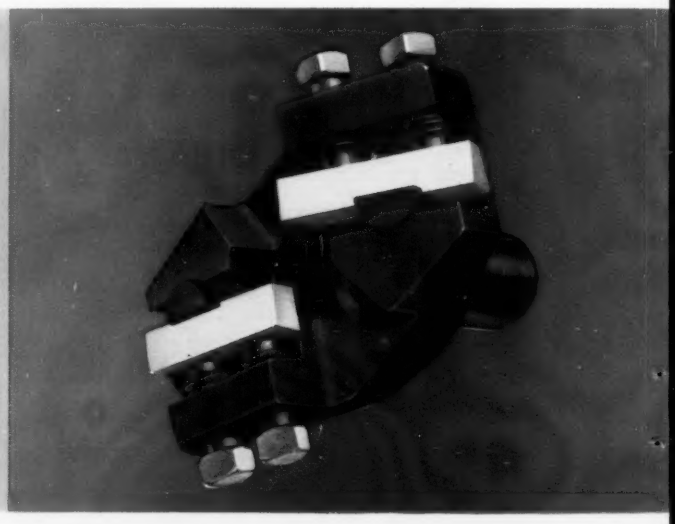
NEW BROWN & SHARPE SCREW MACHINE TOOLS

...designed to give you peak performance on new B&S No. 2 automatics!*

Here are new screw machine tools that fully match the high efficiency of the new B&S No. 2 automatics. They have the capacity, the quick-setting features, the accuracy and the ruggedness that you need for faster production...consistently closer tolerances...on stock ranging from free machining materials to high alloy steels.

Send for complete details today, and ask for the illustrated brochure on the new tools, Form No. S25. Or better yet, plan to visit Brown & Sharpe's new Precision Center in Providence, where you can see for yourself how new B&S No. 2 Automatic Screw Machines, equipped with B&S tools give you *up to 80% faster production!* Brown & Sharpe Mfg. Co., Providence, R. I.



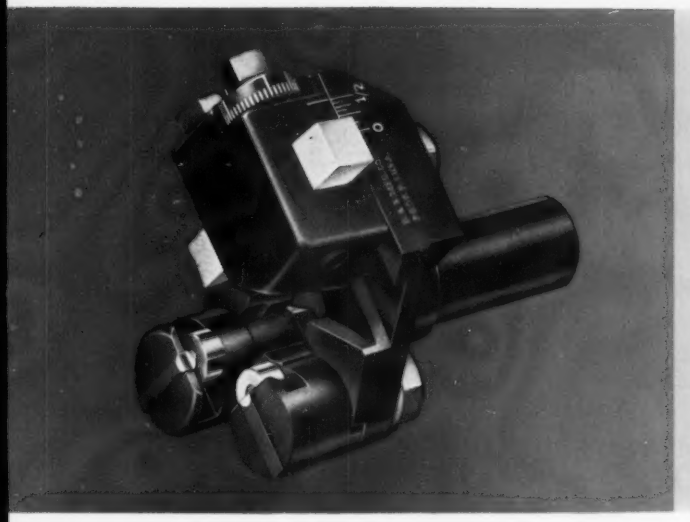


B&S ADJUSTABLE KNURL HOLDER, No. 185 — Requires only one wrench for all adjustments. Knurling length has been increased to 1-3/8" at turning diameters to 1-1/2" . . . 2-1/4" at diameters of 3/16" to 15/16". Knurls are mounted in adjustable swiveling holders, for producing straight, spiral or diamond knurling using straight knurls. Furnished with long-wearing carbide pins and high-speed steel knurls.

B&S BALANCE TURNING TOOLS, Nos. 60, 61 — Offer increased turning capacity of 1/4" to 1-1/4" diameter for a length of 2". Tools are free-cutting and adjustable to a wide range of sizes...feature improved ruggedness for greater strength and rigidity. One set of easy-to-remove blades covers all sizes of work. One blade can remove one-half the chip while opposite blade is set to size, or both blades can be set to size.

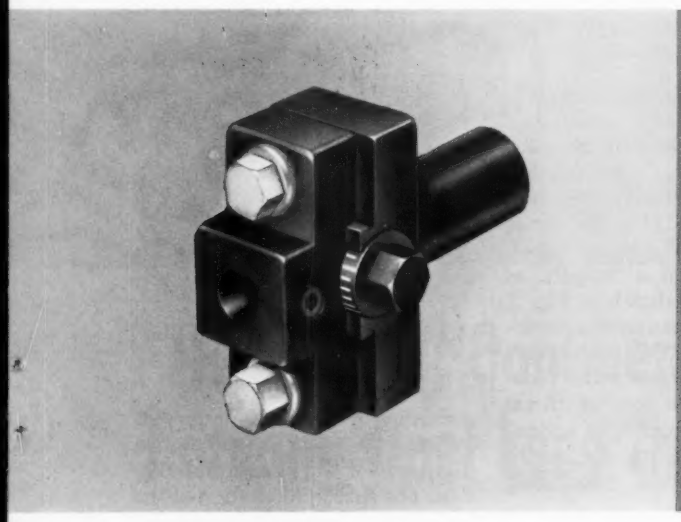
⊛AVAILABLE TO IMPROVE PRODUCTION ON MANY OTHER MACHINES

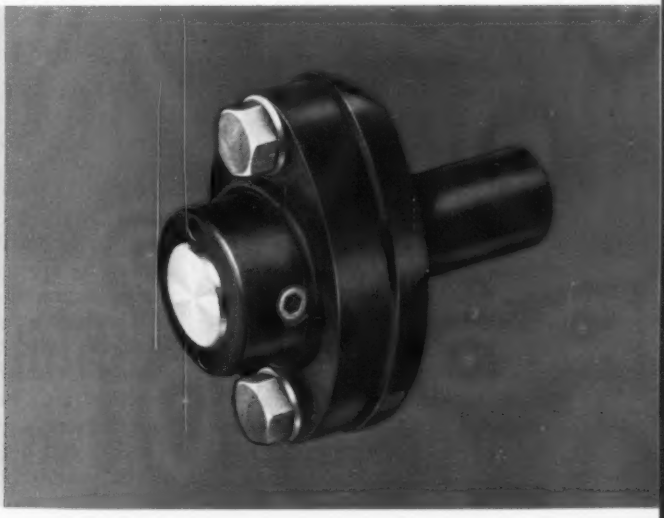
These advanced-design tools in various sizes insure quicker setups, closer tolerances and greater production on all Brown & Sharpe screw machines...on turret lathes and many other machines. Brown & Sharpe engineers will be glad to help you apply the new tools to your own operation.



B&S ROLLER BACK BOX TOOLS, Nos. 51, 52, 53, 54 — Right- and Left-Hand. Offer lower minimum and higher maximum turning capacities (3/16"-1-1/4") . . . quick and accurate setups. Feature one scale for rough setting to diameter plus a graduated adjusting screw for final precision setting. These box tools produce straight, accurate turning with a good burnished finish, without preliminary roughing cuts. Both blade and back rests are adjustable for work of any diameter within tool capacity.

B&S ADJUSTABLE TAP HOLDERS, Nos. 100, 105 — Simplify setup and maintain accuracy. The holder is adjustable to allow quick centering of the tap with the hole. Then it is securely clamped in position. Once the tap is accurately aligned, holder keeps it parallel with axis of work. Available in a non-releasing type, for use on automatics; and in the releasing type, usually used on hand screw machines, which has a clutch mechanism that releases the holder without shock when tap reaches desired depth.





BORING TOOL HOLDER, No. 111 — Ideal holder for the boring tools that are being used to produce straighter, more concentric holes than drill and reamer combinations. Graduated screw adjustment on this tool allows fast setups...and because the slide moves straight across in a horizontal plane, there is no change in vertical centering or cutting clearance when size of hole is changed. Total slide adjustment is 5/16".

B&S FLOATING REAMER HOLDER, No. 67 — Shortens setup time considerably by requiring only one adjustment. The holder floats freely in a vertical plane ...letting the reamer align itself with the hole, while holding the reamer parallel to the hole at all times. Eliminates time-consuming fine adjustment. The float of the tool is mechanically centered to prevent bell-mouthed or egg-shaped holes.

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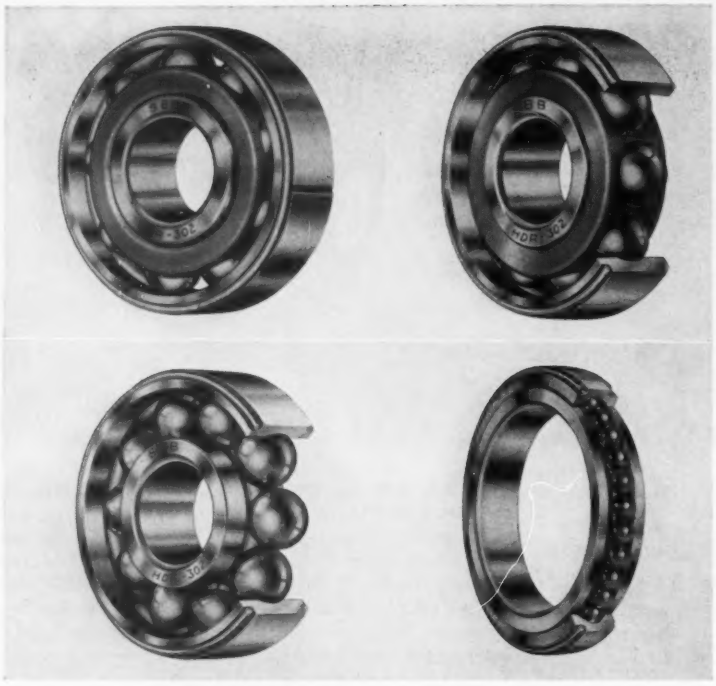


Fig. 1. Split ball bearings of different types manufactured by the Split Ballbearing Corporation

spindle brackets permit the use of ordinary templates for accurately locating the spindles.

A normal spindle travel of 1 1/2 inches is controlled by a rotary limit switch operated through a special shaft in the special head. A safety feature prevents damage to the head in the event of excessive spindle travel in either direction. Another feature built into the axial floating tap-holders guards against damage resulting from the absence of drilled holes for the taps to enter. The illustration shows two holders retracted.

Circle Item 138 on postcard, page 229

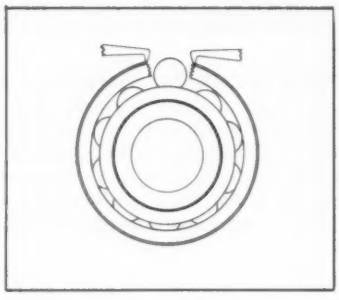


Fig. 2. Diagram illustrating the method of opening the split outer ring of ball bearing

Ball Bearings of Split Race Design

The Split Ballbearing Corporation, Lebanon, N. H., is manufacturing a line of ball bearings based on a new design concept called the "fractured race technique." By fracturing the outer ring of the bearing at one point, it may be opened sufficiently, as shown diagrammatically in Fig. 2, to introduce a maximum complement of balls. The advantages claimed for this method of construction are: no loss of thrust load-carrying capacity, as experienced in the "loading-slot" method or counterbored outer ring method; increased over-all performance (increased number of balls in bearing leads to increased load capacity and increased life of bearing); simplification of ball retainer construction, which in this method is one-piece rather than multiple-piece; and basically new types of bearings, such as the "Type TWF Thin-Section" bearing with integral shields and a full ball complement shown at lower right corner of Fig. 1.

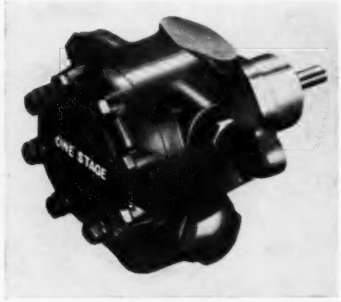
The fractured ring closes by its own resilience and is secured by circumferential holding wires or rings. It is claimed that the fracture does not weaken the bearing.

Circle Item 139 on postcard, page 229

Pump for Lubricating and Hydraulic Oils

New standard Model OB pumps designed to handle lubricating, hydraulic, and light fuel oils at pressures up to 300 pounds per square inch and speeds up to 1800 R.P.M. are announced by the Sundstrand Hydraulic Division, Sundstrand Machine Tool Co., Rockford, Ill. These pumps are available either as fully standard units for prompt delivery or they can be incorporated into existing or new equipment. Where higher speeds—up to 3600 R.P.M.—are needed, modified versions with special gearing are available.

Pumping capacity is 24, 30, or 39 gallons per hour with either right- or left-hand rotation types available. Either two-bolt integral

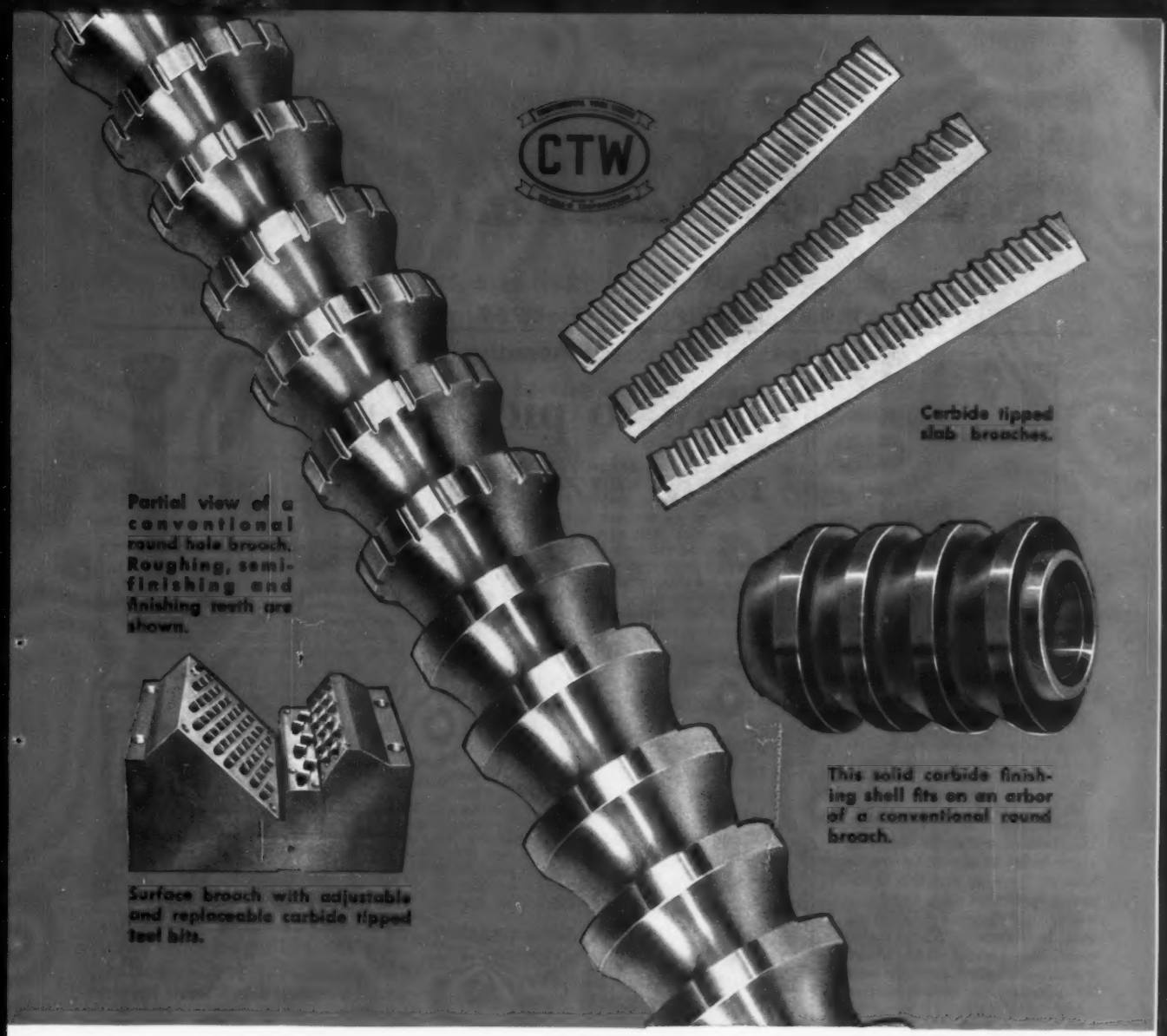


Sundstrand pump for handling lubricating and hydraulic oils

mounting or bracket type mounting may be used, depending on the needs of the specific installation. The special tooth form of the Rota-Roll pumping gear reduces friction and provides positive pumping action that produces a maximum vacuum of 20 to 25 inches of mercury. A mirror-lapped, Nitralloy seal, flexibly held against a special dry lubricated bronze bushing clamped to the shaft, prevents leakage along the shaft. An optional feature of the pumps is a large, integral strainer of 90 by 100 mesh.

Circle Item 140 on postcard, page 229

(This section continued on page 234)


CTW
Carbide tipped slab broaches.
Partial view of a conventional round hole broach. Roughing, semi-finishing and finishing teeth are shown.
This solid carbide finishing shell fits on an arbor of a conventional round broach.
Surface broach with adjustable and replaceable carbide tipped tool bits.

Here's Why Continental Quality Broaches Actually Cost Less Than Ordinary Broaches

After all, the price paid for a broach may be only the beginning of broaching expense. To the original cost of the broach must be added the cost of work delays, scrapped parts, and time-consuming adjustments.

However, if the broach is free cutting, holds the required tolerances and finishes, with the maximum pieces per tool, your original cost may be your only cost.

Because Continental effectively combines quality materials, skilled craftsmanship, and engineering experience, it is a fact: "the best broaches cost less."

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Division of
Ex-Cell-O Corporation
Detroit 32, Michigan

56-64

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Nuts — their use and abuse

With bolts tightened to high load levels, nut performance becomes critical.

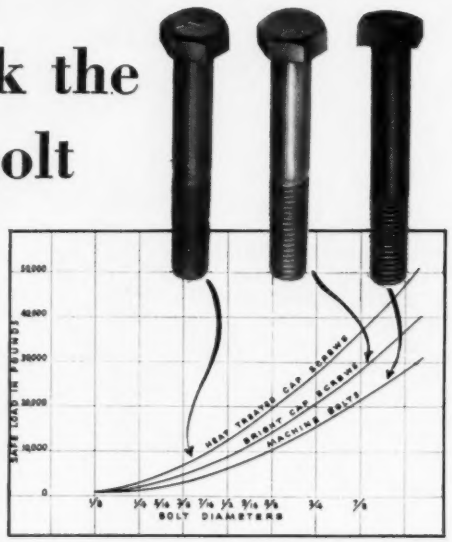
A nut produces bolt tension by rotating and advancing on the bolt threads. To do this, there must be a mating condition of threads, which is influenced by thread lead. Lead is a matter of tolerance only before bolt is stressed. When tightened, the nut is then under compression and threads tend to contract; the bolt is in tension, and threads tend to stretch. Lead of thread is affected–elastically *before* yield point, permanently *beyond* it.

This shortening of one lead and lengthening of the other has two effects. (1) The load distributes unequally along the threads (2) Torsion on bolt increases. Something has to give. For high tensile bolts especially, it is better for the nut to do so. A nut therefore should be soft enough so that it deforms plastically and compensates for off-lead. If it does, it *distributes* the load and can advance to increase tension.

"SOFT" NUTS DO MOST JOBS

"Soft" nuts do adjust more readily than hard ones under these severe conditions. While such nuts may not be as strong in shear as heat treated ones, the important point is the bolt tension they produce. As long as the nut can pull the bolt well into its plastic range, it is doing more than its share of the job.

How to pick the right size bolt



When it comes to uniformity of dimension, quality of head and thread, and ease of assembly, all RB&W cold headed fasteners are the same. They differ mainly in tensile strength as shown here.

ALMOST all bolt and cap screw strength requirements can be satisfied from three types of *standard* fasteners without recourse to costly special alloys. In the widely used middle range of sizes, the problem is one of deciding which makes the best joint, or which proves the most economical for the job.

MORE FOR LESS

Suppose, for example, you need a bolt safe for 20,000 pounds of loading. As the chart shows, you could use an RB&W ⅞" square-head bolt, a ¾" bright cap screw, or a ⅝" heat treated one.

If you have a lot of holes to fill, use the larger, lower strength fasteners. But to cut down number of bolts, or their size (and therefore cost), go to the higher tensiles. However you gain nothing if you don't tighten high tensile bolts to their full strength.

HOW COSTS COMPARE

In terms of holding power: For each $1.00 in high tensile bolts, it costs $1.50 to provide equivalent clamping force with bright cap screws; or $1.65 with machine bolts.

For more suggestions on fastener economy or for copy of above curves, write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

Spin-Lock Nuts dig in to stay tight

The photograph shows the many hardened "anchors" on the flange of a Spin-Lock Nut. These "ratchet-action" teeth require 20% more torque to loosen than to tighten. They bite in as the nut turns down on its seat. Like Spin-Lock Screws, these nuts can stay put in products subject to vibration and cyclic temperature variations. Send for bulletin.

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On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

GAS REGULATORS—Air Reduction Sales Co., New York City. 40-page catalogue covering the company's complete line of pressure regulators for industrial compressed gases. Various types of cylinder, manifold, and pipeline regulators, both single- and two-stage; and a variety of specialized equipment such as laboratory and metering regulators, and gas proportioners are described. Flow and pressure charts in graph form give performance data. In addition, related equipment—such as station valves, adapters, hose connections, and pressure gages—are illustrated and discussed. 1

METALWORKING MACHINERY—Julius Blum & Co., Inc., Carlstadt, N. J. Catalogue No. 26, describing a variety of shop equipment and supplies with special emphasis on the requirements of small- and medium-size metal fabricators. Subjects covered include equipment for bending, grinding, punching, shearing, sawing, welding, forging, drilling, tapping, threading, notching, materials handling, and similar equipment. A motor-driven scroll bender, a hydraulic punch and angle shear, and a line of multi-purpose inert gas and metallic arc alternating-current and direct-current welders are also described. 2

V-DRIVES—Maurey Mfg. Corporation, Chicago, Ill. 46-page catalogue providing a convenient source of information on fractional horsepower V-drives and drive parts and accessories. In the range of fractional to 10 hp, the catalogue presents easy-to-read descriptions and complete size data on the company's line of bushed type and fixed bore type, cast-iron, and pressed steel V-belts; V-pulleys; refrigeration fans and fan pulleys; and V-drive accessories. An engineering data section to aid in selection of proper drive is also included. 3

INDUSTRIAL GAS EQUIPMENT—Linde Company, Division of Union Carbide and Carbon Corporation, New York City. 24-page catalogue describing industrial gas manifolds with automatic controls. Information is given on acetylene generators capable of supplying from 100 to 9000 cubic feet of acetylene per hour. Recommended uses and specifications are given for a complete selection of equipment for gas piping systems, including hydraulic back pressure valves of all types; relief valves; station valves; oxygen filters and station check valves. 4

HYDRAULIC CYLINDERS—Vickers Incorporated, Detroit, Mich. Bulletin 57-68, illustrating recent improvements in design and additional mountings for the company's compact hydraulic cylinders. The bulletin provides detailed information on the construction and features of the company's 2000-psi cylinders, including the trunnion-mounted cylinders. Complete tables of sizes and dimensions and useful engineering data on application, mounting, piston areas and speeds, cylinder cushion length, and circuits are also included. 5

GANG SLITTERS AND SCROLL SHEARS—E. W. Bliss Co., Canton, Ohio. Catalogue describing the company's complete line of single, gang and automatic duplex slitters, as well as scroll shear for medium- and high-speed can-making lines. Also illustrated and described are the company's body blank stacker, motor-driven grinding attachment, and a full line of slitter accessories. Design and construction features of all machines for plain or lithographed tinplate are described, and dimensions are listed. . . 6

STAINLESS STEEL—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Technical data sheet entitled "Allegheny Stainless Steel Type 418 Special," describing a special stainless steel that is used for jet-engine parts, high-pressure valves, and steam and gas turbine parts. Technical data including physical and mechanical properties, resistance to corrosion, and oxidation are included. Type 418 steel is recommended for use in the 750- to 100-degree F. range. 7

DIESEL-ENGINE COMPRESSORS—Ingersoll-Rand, New York City. Bulletin 207, describing the company's integrally built diesel-engine compressors for use in industrial plants, mines, construction projects, and chemical plants. The unit combines a four-cycle, V-angle, heavy-duty diesel engine and the slow-speed, horizontal compressor on a single crankshaft without the use of gears or other coupling mechanism. Designated SVO, the compressor is built for continuous full-load operation. 8

SEMI-STEEL VALVES—Rockwell Mfg. Co., Pittsburgh, Pa. 43-page bulletin (V-203, Rev. 1), covering the entire Rockwell-Nordstrom semi-steel valve line. Included are two full pages of photos, drawings, and detailed description of lubricants and lubricating methods; and cut-away photos showing in detail the working parts of the four principal types of semi-steel valves—two-bolt cover, screwed gland, bolted gland, and multi-port types 9

WEATHER-PROTECTED MOTORS—Allis-Chalmers Mfg Co., Milwaukee, Wis. Illustrated catalogue 51B8606A, describing the company's weather-protected motors (Type FOD) in ratings from 250 to 900 hp. These motors feature a sturdy steel frame, a removable prewound stator assembly, insulation, capsule-mounted split sleeve bearings, removable air ducts, and protective screens. 10

RESISTANCE-WELDED PRODUCTS—Taylor-Winfield Corporation, Warren, Ohio. 24-page bulletin SP-18, illustrat-

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ing resistance welding production developed by the company's research laboratory. Included are photos and descriptions of more than 300 different items mass-produced by resistance welding. Covered are spot, projection, flash-butt, upset-butt, and seam welding; electro forging and special applications in non-ferrous metals, stainless steels, and aluminum. **11**

COLLETS AND FEEDERS—Sutton Tool Co., Sturgis, Mich. 24-page catalogue containing helpful details for the solution of collet and feeder problems. Featured are the company's standard collets and feeders, quick-change master collet and Style L master feeders, full-floating master collets, Burns style taper lock master feeders, and the Sutton super feeder. Each model is fully covered with price lists, ordering instructions, cross-sectional views, and illustrations. . . . **12**

HIGH-PRESSURE REGULATORS—Rockwell Mfg. Co., Pittsburgh, Pa. Bulletin 1024-6, describing the complete line of the company's high-pressure regulators. Information is given on the recently introduced 141 regulator which will withstand momentary overloads as high as 1000 psi on the outlet side without damage to the regulator. The 173 regulator is also described with photos and drawings illustrating several typical hookups. Complete capacity tables on the 141 and 173 are given. **13**

HEAVY-DUTY ENGINE LATHE—R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Bulletin HD-143, describing the company's 20-inch, heavy-duty engine lathe designed especially for carbide and ceramic tools. Some of the features are the 40-hp headstock, fine-increment selection of thirty-six speeds, new two-speed tailstock, scientifically planned operator convenience, and various others. Complete specifications are included. **14**

CYLINDERS—Logansport Machine Co., Logansport, Ind. Catalogue 100, Section 5, describing the company's Logansquare cylinders for air or oil service. These cylinders are equipped with hardening and chrome-plated piston rods and are built in fourteen different mounting styles to meet a wide range of mounting requirements. Cylinder sizes range from 1 1/2- to 8-inch bores. Operating pressures are 150 psi air service, or 300 psi oil service. **15**

DRIVE UNIT—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Catalogue 5188166A entitled "'Ultra-Speed' Package Drive Units," describing the company's ultra-speed for the drive unit available in ratings from 5 to 200 hp. This unit is a complete direct-current conversion device, consisting of a motor-generator set and control equipment mounted in a compact ventilated cabinet. **16**

DIP-BRAZING METHOD—Handy & Harman, New York City. Bulletin 23, describing the company's Alumibraze, an alloy in a new form that offers an improved method for joining aluminum parts. Step-by-step details on dip brazing with this powdered aluminum silicon alloy—which is applied to the joint in the form of a paste—are given. **17**

OXIDE CUTTING TOOLS—Stupakoff Division of the Carborundum Company, Latrobe, Pa. 12-page catalogue describing the company's Stupalox high-strength, oxide-base cutting tools. In addition to technical description and a table of physical properties, tool-holders, dimensions and prices of Stupalox throw-away inserts, solid inserts, and unground blanks are included. **18**

SINGLE-POINT TOOLS—Viking Tool Co., Shelton, Conn. Catalogue 571, listing three separate lines of single-point lathe tools. Two sections cover single-point tooling that utilizes throw-away inserts, and the third section, extra-heavy-duty regrindable insert tools. A section of engineering specials is also included outlining the Viking broached slot-holder design. **19**

INDUSTRIAL GEARING—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-7012, outlining the design facilities and manufacturing capacity of the company's gearing division. Specialized machinery and heat-treating equipment are shown along with the heat-treating process, emphasizing the BP taper-hardening process. A complete machinery listing is also included. . . . **20**

VERTICAL ELECTROSPARK MACHINE—Ex-Cell-O Corporation, Detroit, Mich. Bulletin 43373, describing application of the Method X process of electrospark machining to the company's Style 243-6 vertical electrospark machine. A detailed explanation of the Method X process is given, as well as a working description, floor plan, and specifications of the new machine. **21**

SPEED REDUCERS—Cone-Drive Gears Division, Michigan Tool Co., Detroit, Mich. 24-page bulletin describing the company's double-enveloping worm-gear Cone-Drive speed reducers in standard stocked capacities ranging from fractional to 65 hp. Instructions for selecting the proper speed reducer, using of service factors, installation, and maintenance are included. **22**

OPTICAL TOOLING EQUIPMENT—Keuffel & Esser Co., Hoboken, N. J. Catalogue listing the company's entire line of optical tooling equipment. Information is included on jig transits, alignment telescopes, and Paragon tilting levels, together with a large number of accessories, instrument stands, fixtures, collimators, scales, targets, and optical attachments, including the optical square. **23**

RADIAL DRILL PRESSES—Walker-Turner Division, Rockwell Mfg. Co., Pittsburgh, Pa. 4-page bulletin describing the improved line of Walker-Turner radial drill presses. These tools permit moving of the spindle head to the work, eliminating need for special jigs and fixtures. Close-up photos and drawings are used to describe the principal features of all models in this line. **24**

STUD WELDING—Nelson Stud Welding Division, Gregory Industries, Inc., Lorain, Ohio. 24-page design manual giving tips for design engineers on how to take full advantage of the savings possible with stud welding. Manual contains full descriptions and physical properties of the various stud types, including the standard CP stud which is recommended for the majority of applications where a straight-threaded stud is required. . . **25**

RESISTANCE WELDING MACHINES—Taylor Winfield Corporation, Warren, Ohio. Bulletin 8-413, describing thirty-

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1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 48 49 50 51 52

NEW SHOP EQUIPMENT

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115 116 117 118 119 120 121 122 123 124 125 126 127 128
129 130 131 132 133 134 135 136 137 138 139 140 141 142
143 144 145 146 147 148 149 150 151 152

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two multi-spot and projection resistance welding machines. For each welder are listed: end product, type of operation, production rate, and associated materials-handling equipment. Products covered include automotive parts, appliances, precision instruments, electric motors, and basic steel. **26**

END-MILL CHART—DoALL Co., Des Plaines, Ill. Wall chart designed as aid in the selection of proper end-mill speeds for specific applications, listing recommended surface speeds in feet per minute for most metals and translating these figures into revolutions per minute for end-mills of diameters ranging from 1/16 inch to 2 1/2 inches. **27**

INDEXING MACHINE COMPONENTS—Hartford Special Machinery Co., Hartford, Conn. 8-page data sheet set, presenting specifications on standard componets for the 65-inch horizontal indexing machine. Self-contained components which are engineered for quick assembly into complete low-cost, high-production automatic machines are illustrated. **28**

CARBIDE GAGES AND THREADING TOOLS—Detroit Tap & Tool Co., Detroit, Mich. Bulletin CT-56, giving specifications and prices for plain cylindrical and thread plug carbide gages. Plain cylindrical gages are listed in reversal wire type and AGD taperlock type; thread plug carbide gages in taperlock and trilock types, and also in reversal types. **29**

CURRENT-LIMITING FUSES—General Electric Co., Schenectady, N. Y. Bulletin GEA-6319B, describing the company's line of CLF current-limiting fuses capable of interrupting short-circuit currents up to 200,000 symmetrical amperes. Bulletin describes operation and typical application of fuses, including dimensions and ratings. **30**

PRESS BRAKES—Dreis & Krump Mfg. Co., Chicago, Ill. 16-page catalogue describing the company's Series A, B, C, and L Chicago press brakes. The principal construction features are outlined, and complete specifications of the different sizes of brakes in the 30-, 36-, 50-, and 60-ton capacities are given. **31**

POWER MACHINES FOR SHEET METAL WORK—Niagara Machine & Tool Works, Buffalo, N. Y. 40-page pocket-size booklet 203, summarizing important data on the company's power-operated machines for plate and sheet-metal work, and bringing together data on each series in the line. Basic specification charts tabulated for easy reading provide quick reference to all principal models. **32**

MILLING CUTTERS — McCrosky Tool Corporation, Meadville, Pa. Bulletin 572, describing the company's Series 900 milling cutters with Super-Jack locking wedges for milling with square and triangular indexable throw-away carbides. Design and construction, dimensions, and other specifications are included. . . . **33**

METAL PIPE AND TUBING—Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. 12-page folder TDC-185, describing the company's seamless titanium metal pipe and tubing. Presented in detail are size ranges and tolerances, as well as a complete description of the mechanical, physical, and working properties of the metal in tubular form. **34**

FORMING AND CUTTING-OFF MACHINES—Brown & Sharpe Mfg. Co., Providence, R. I. Bulletins SM 28 and SM 29, illustrating and describing two new versions of the company's 00 automatic screw machine—one for fast forming and cutting-off operations, and the other for all automatic operations except threading. **35**

COLLAPSIBLE TAPS—Landis Machine Co., Waynesboro, Pa. Bulletin G-95, describing the company's Style LL collapsible taps available for stationary and rotary applications and recommended for precision taper tapping. There are four sizes of taps with detachable heads providing a wide range coverage. **36**

COMPRESSORS—Ingersoll-Rand Co., New York City. Illustrated folder describing the company's new air compressor to be known as "Channel-Flo"—a two-stage, 200-psi-rated motor compressor available in 1 1/2- and 2-hp sizes. **37**

HEAT-TREATING EQUIPMENT—C. I. Hayes, Inc., Cranston, R. I. 12-page bulletin describing design advantages and available sizes of the company's line of hardening, preheat, high-speed steel, tempering, and vertical furnaces. . . . **38**

CENTERLESS GRINDER—Royal Master, Inc., Riverdale, N. J. Brochure describing the company's TG-12 centerless grinder

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capable of grinding a wide range of materials, including plastics, tungsten-carbide, wood, glass, hard rubber, etc. Detailed description of the mechanical features is included. 39

STAINLESS-STEEL BAR AND WIRE—Armco Steel Corporation, Middletown, Ohio. 24-page booklet describing forty-five types of stainless steel available in bar and wire. Advantages, properties, fabrication, electropolishing, ebonizing, and supply information are included. 40

TAPS—Besly-Welles Corporation, South Beloit, Ill. Catalogue giving detailed information on the company's taps. For easy size selection, there is a table giving complete information on class of fit, limit numbers, and gage data, as well as availability from stock. 41

WORM-GEAR DRIVES—Cleveland Worm & Gear Co., Cleveland, Ohio. Bulletin 145, giving information on the company's worm-gear drives and providing useful summary information on the complete standard line of speed reducers, worm-gear sets, and special units manufactured by the company. 42

DRILLS AND REAMERS—Chicago-Latrobe, Chicago, Ill. Booklet entitled "Care of Drills and Reamers," containing technical data on using, sharpening, and handling of drills and reamers made of high-speed and carbide steel. 43

CIRCULATING OIL SYSTEM—Farval Corporation, Cleveland, Ohio. Bulletin 70, describing the company's Lubrival circulating oil system for application on presses of semi-automatic and automatic machine tools with built-in return oil arrangements. 44

CONVEYOR PULLEYS—Chain Belt Co., Milwaukee, Wis. Bulletin 5781, covering welded-steel conveyor pulleys for belt conveyor and bucket elevator systems. Drum types and the self-cleaning wing type pulleys are included. 45

TAPPING ATTACHMENTS—Ettco Tool & Machine Co., Inc., New York City. 6-page illustrated catalogue No. 22A, featuring the company's Ettco-Emrick high-speed, sensitive tapping attachments that run in oil. 46

VIXEN FILES—Heller Tool Co., subsidiary of Simonds Saw & Steel Co., Newcomerstown, Ohio. Illustrated catalogue describing the company's milled curved-tool files. Dimensions and specifications are included. 47

CONTOUR MILL—Colonial-Romulus Division, Colonial Broach & Machine Co., Detroit, Mich. Bulletin CRH-57, describing the company's Hydro-Cycle contour mill, a hand-guided tracer machine. 48

PRECISION BORING MACHINE—Jones & Lamson Machine Co., Springfield, Vt. Illustrated folder describing the company's single- and double-spindle precision boring machines and giving hints for low-cost precision boring. 49

SCREW MACHINE TOOLS—Brown & Sharpe Mfg. Co., Providence, R. I. 8-page bulletin describing new tools for the company's No. 2 automatic screw machine. Capacities and dimensional data are included. 50

MOLDING PRESSES—F. J. Stokes Corporation, Philadelphia, Pa. Catalogue No. 200, describing the company's redesigned Model 741 series of fully automatic compression molding presses. 51

MARKING DEVICES—M. E. Cunningham Co., Pittsburgh, Pa. 4-page bulletin describing the company's Mecco safety steel stamps, holders, fixtures, and other marking devices. 52

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 48 49 50 51 52

NEW SHOP EQUIPMENT

101 102 103 104 105 106 107 108 109 110 111 112 113 114
115 116 117 118 119 120 121 122 123 124 125 126 127 128
129 130 131 132 133 134 135 136 137 138 139 140 141 142
143 144 145 146 147 148 149 150 151 152

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This card is void after September 1, 1957 M-6/57

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Firm Address .....

City ..... Zone ..... State .....

Chief product manufactured at this plant: .....

Approximate number of employes (check one):

UNDER 50 51-100 101-500 501-1000 OVER 1000

M 6/57

By having your own copy you can clip and file articles, Reference Sections, and Data Sheets for your own use . . . take plenty of time to read the important material in each issue.

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Just fill in and mail this postcard today, and we'll start your subscription at once. *IN ADDITION, WE SHALL SEND YOU — FREE — A LOOSE-LEAF BINDER CONTAINING 148 PAGES OF DATA SHEETS . . . A BINDER THAT GROWS IN USEFULNESS EACH MONTH AS YOU ADD NEW MATERIAL.*

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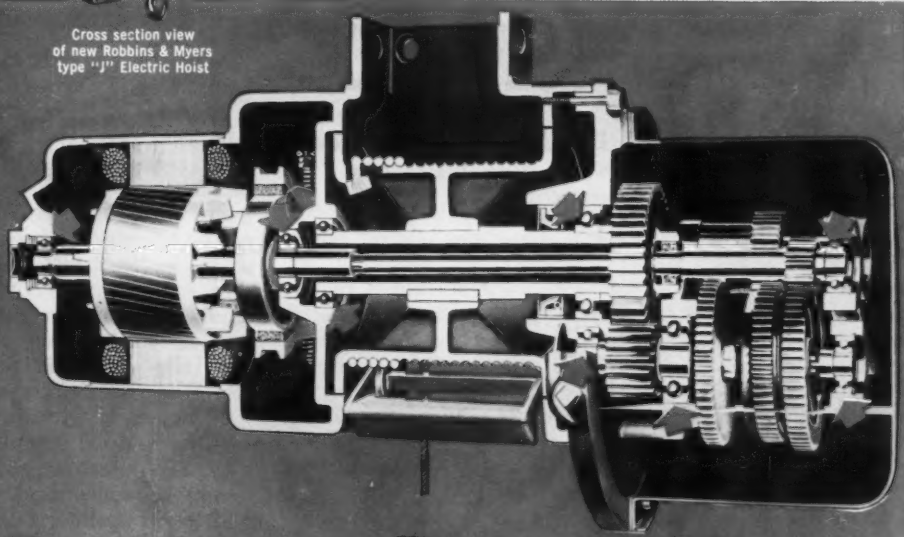
9 PROVEN POINTS OF QUALITY ENGINEERING IN A LOW-COST HOIST

Cross section view of new Robbins & Myers type "J" Electric Hoist



The Fafnir 9100K Series ball bearing is designed basically for applications where housing diameters are restricted and maintenance of relatively large shaft diameters is essential. Available with seals or shields.

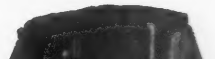
The Fafnir 200K Series ball bearing is well suited for applications requiring light to moderate loads combined with relatively high speeds. Available with seals, shields, and snap rings in various degrees of precision and retainer construction.

WHEN the design engineers of Robbins & Myers were asked to develop a low-cost electric hoist that would measure up to R & M standards of quality, they made good use of Fafnir Ball Bearings. They specified them to insure precise alignment of parts, conservation of power, minimum maintenance, reserve capacity for long life. In three critical locations they specified Fafnir Plya-Seal bearings — the bearings that provide superior retention of lubricant and positive protection against contaminants. With these and other construction features, they came up with the design of the new Robbins & Myers low-cost, "J" hoist, *quality engineered throughout.*

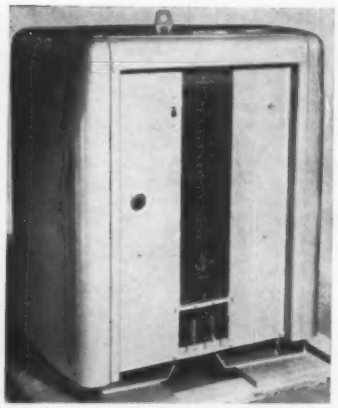
Fafnir is a supplier of ball bearings for leading industrial hoists, hoist trucks, and hundreds of other industrial machines and equipment where ball bearing advantages improve performance and prolong service life. In case after case, the choice of Fafnir Ball Bearings is influenced by the Fafnir "attitude and aptitude"—a way of looking at bearing problems from the designer's viewpoint and the ability to supply the right ball bearing to fit the need. Perhaps these attributes can help you solve a bearing problem. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

For more information fill in page number on Inquiry Card, on page 229



Model LB15A with AUTOPOSITIONER
Table size 44" x 24" (illustrated)



Submerged-arc welder placed on market by the General Electric Welding Department

G-E Submerged-Arc Welder

A 1000-ampere, alternating-current transformer type welder, designed primarily as a power source for the submerged-arc welding process, has been announced by the General Electric Co.'s Welding Department, Schenectady, N. Y. This single-phase welder has an operating range of from 325 to 1000 amperes and is provided with motor-driven current control. Remote control of both welder output and primary contactor is also made available by a plug and receptacle.

With output open-circuit voltages of 85 to 100 volts, the unit has power factor correction capacitors and operates on a reconnectable 230- to 460-volt input. Built into the welder is a 2-K.V.A. control transformer, which can be used externally for operating auxiliary equipment.

The unit is rated for continuous-duty cycle at 1000 amperes. All coils are protected by Class H insulation at 130-degree C. temperature rise. A built-in current transformer with a ratio of 1500 to 5 is provided to facilitate measurement of the welding current.

Circle Item 141 on postcard, page 229

Bench Type Deep-Throat Punch Press

A Model BD-3, 3-ton, power bench type, deep-throat punch press, designed especially for small tonnage operations requiring a large throat space, has been announced by Alva Allen Industries, Clinton, Mo. This press will perform up to 300 operations per minute on continuous punching, forming, blanking, cutting, drawing, shearing, and riveting work in metal, leather, plastics fiber, textile, paper, or other workable material within its rated capacity.

The quick-action single-pin clutch has a simple, positive, non-repeat, or repeat action. All contact parts are heat-treated for maximum life. Straight ram guides with a flat gib assure accurate fitting of dies for precision stamping. The accurate ram adjustment has a simple, positive locking device.

The standard stroke is 3/4 inch with 1/4- to 1 1/2-inch strokes available at an additional charge. The V-belt drive requires only a 1/3-hp motor.

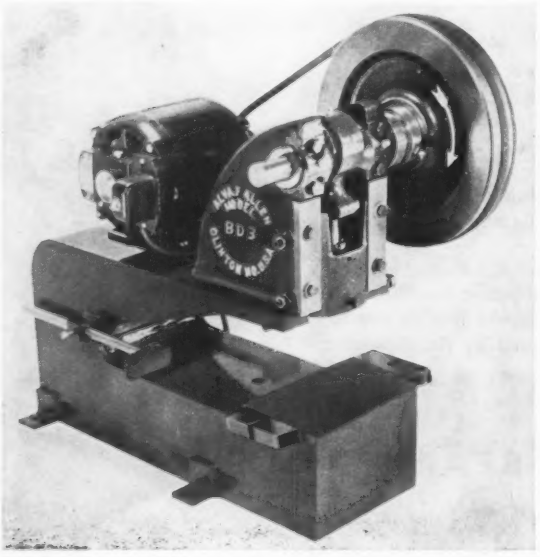
Circle Item 142 on postcard, page 229

Automatic Lead-Screw Tapping Head

Automatic Methods, Inc., Elizabeth, N. J., is manufacturing a fully automatic lead-screw tapping head, called the "Auto-Tap." This high-speed, self-contained tapping unit has a built-in air motor with electrical controls. It can be operated from a drill press or by a direct motor drive. Its three-way control box permits finger-tip control, foot-switch control, or remote control setup for the fully automatic production line. The low-pressure air motor is designed to provide extreme sensitivity, assure repetitive accuracy and precision, avoid tap breakage, reduce work spoilage, and lessen operator fatigue. The "Auto-Tap" operates on an 8-volt transformer connected to a 110-volt outlet. The tap range is 0-80 to 3/4-10, with a 2-inch stroke.

Circle Item 143 on postcard, page 229

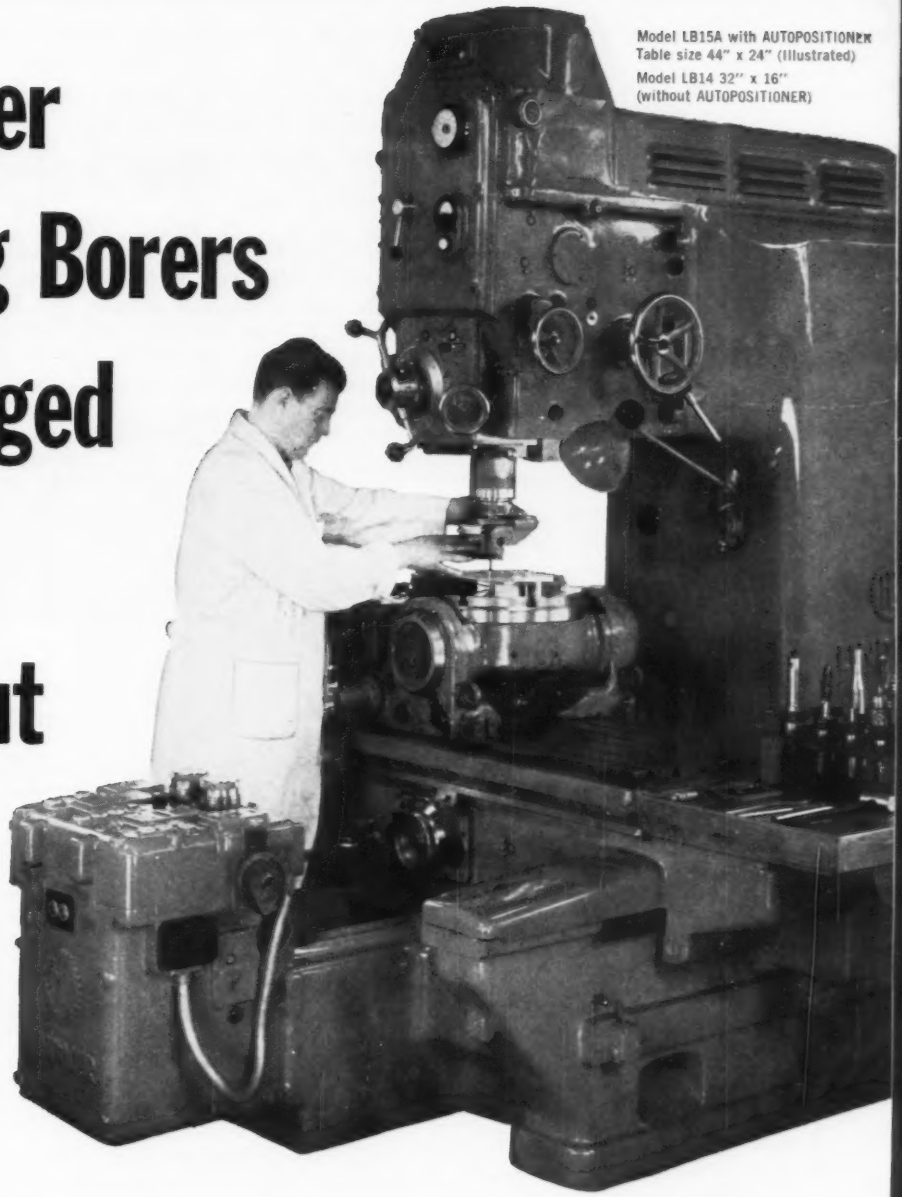
(This section continued on page 236)



Allen deep-throat bench type power press

"Auto-Tap" automatic lead-screw tapping head

why Lindner Optical Jig Borers have changed so many ideas about jig boring



Model LB15A with AUTOPOSITIONER
Table size 44" x 24" (Illustrated)
Model LB14 32" x 16"
(without AUTOPOSITIONER)

Optical measuring system does not depend on lead screws, gage blocks, bars or limit switches—is permanently protected against mechanical wear. Only a light beam touches helically scribed cylindrical measuring scales which are independent of table movement mechanism and are *immovable* in axial direction.

AUTOPOSITIONER® enables operator to preselect table position for next hole while one boring operation is in progress—eliminates non-productive time between holes. As one hole is completed, table moves in rapid traverse to the next preselected position.

Photo-electric optical centering device minimizes visual fatigue and errors in settings—permits initial and repeat settings guaranteed accurate within .00015" and readings in .00005".

Projection screen eliminates operator eye strain and bending—helical line from measuring scale is projected on 2½" x ¾" screen which operator reads in standing position without eyepiece.

Automatic table clamping prevents errors in clamping and unclamping table between movements.

● ***Send for 25-minute movie film demonstration***

KO CO., INC. INDUSTRIAL IMPORTERS

KURT ORBAN COMPANY, INC.

42 Exchange Place, Jersey City 2, N. J. • In Canada: 2490 Eglinton Ave. W, Toronto

All-bronze coolant pump made by Sutton Mfg. Corporation

Sutton All-Bronze Coolant Pump

An all-bronze, corrosion-resistant coolant pump, designated CTU-115, made by the Sutton Mfg. Corporation, Norfolk, Va., has no bearings or metal-to-metal contacts that can be harmed by pumping abrasive-laden liquids. The unit will pump coolants, cutting oils, soluble compounds, and other liquids to milling machines, lathes, cut-off machines, belt sanders, grinders, or any other machine requiring copious quantities of liquid.

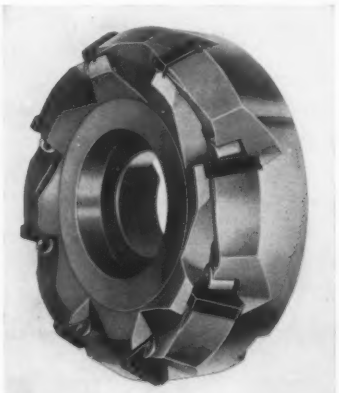
Circle Item 144 on postcard, page 229

Milling Cutter with Throw-Away Inserts

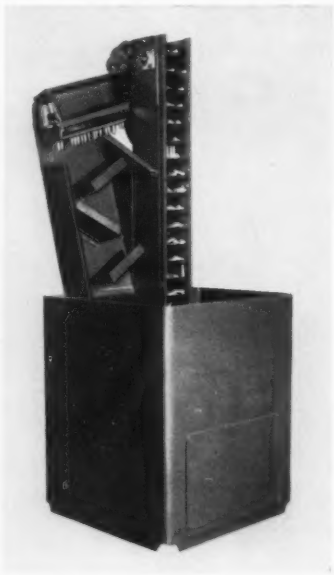
Newcomer Products, Inc., Latrobe, Pa., has announced an RC milling cutter for use in high-speed milling with throw-away carbide inserts. The design features a hardened alloy steel, two-piece cutter body and patented "Super Jack-Locks" to rigidly hold each insert. A simple indexing procedure permits rapid removal of worn insert and indexing to a new cutting edge.

The milling cutter is available in four styles using square or triangular type inserts. Each style can be had in standard nominal sizes to fit the standard drive with present adaptors and machines. No special conversion adaptors are required.

Circle Item 145 on postcard, page 229



Newcomer milling cutter with throw-away carbide inserts



Elevating hopper made by the Production Feeder Corporation

Elevating Hopper for Feeding Parts Automatically

Sliding, rolling, or headed parts are fed automatically into production machines at predetermined speeds by a Model No. 2000 elevating hopper manufactured by the Production Feeder Corporation, Mentor, Ohio. Work-pieces are picked up from a storage hopper by a moving, cleated steel belt conveyor and elevated to an adjustable roll orienting mechanism. Oriented parts then are fed into a work chute to the production machine. Parts that are not oriented are routed by rubber-lined baffles back into the hopper. The rate of feed is controlled by the variable-speed conveyor.

Each electrically controlled unit is completely self-contained and has an adjustable orientating mechanism, elevating conveyor, variable-speed transmission, motor, and a 6-cubic-foot storage hopper with a low 36-inch loading height. The unit requires minimum tooling changes to accommodate parts of different shape.

The elevating hopper will handle rolling parts up to 2 3/8 inches in diameter and 1/8 inch in length; sliding parts 3/16 inch to 1 1/4 inches in diameter and 3 1/2 inches in length; headed parts 3/16 inch to 1 1/4 inches head diameter and 3 1/2 inches in over-all length.

Circle Item 146 on postcard, page 229

Niagara Redesigned Adjustable Bed Presses

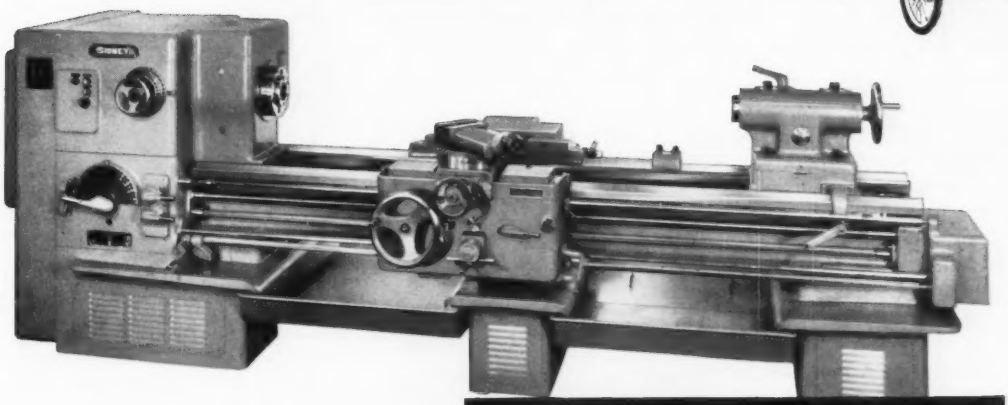
An extensively modernized and redesigned line of adjustable bed presses is being built by the Niagara Machine & Tool Works, Buffalo, N. Y., and is available for use in the automotive and appliance industries. These compact presses incorporate many specialized controls and devices, neatly recessed in the side walls or completely housed behind flush panel doors. They are specially equipped for secondary operations and can be installed between automated presses in the production line to achieve faster, safer, and more efficient output.

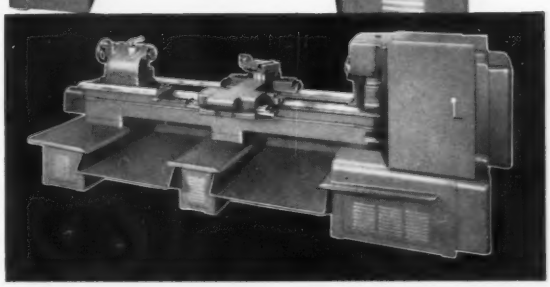
Adjustable press of line redesigned by Niagara Machine & Tool Works

Circle Item 147 on postcard, page 229

(This section continued on page 238)

Your Present Lathes may be Older than you think!





Date of purchase doesn't tell enough —some lathes grow older and weaker sooner than others . . . your costs go up as efficiency and production fall lower and lower. You can't expect old-timers to keep up today's swift pace! The remedy is simple . . . the results are astounding . . . and now is the time to face up to the facts.

SIDNEY DIAL-MASTER MODEL 32 LATHES

stay young, vigorous and more productive longer.

These lathes are designed and constructed to occupy a minimum of floor space so they can be integrated for convenience and efficiency into your plant layout.

Note these Features:

- **HEAD STOCK WITH HERRING-BONE GEARS** provide smooth operation, greater strength and elimination of end thrust thru the double opposed 30° helix angle. Constant flow of power. Filtered automatic forced feed lubrication.
- **32 PRE-SELECTIVE SPINDLE SPEEDS** obtained by rotating dial control. Shift from speed to speed in a lightning-like TWO SECONDS.
- **SINGLE LEVER CONTROL ON CARRIAGE AND APRON** actuates positive serrated jaw plates incorporating all four directions of feed and rapid traverse operating from one control head. All gears (except rack pinion) are enclosed. Automatic lubrication.
- **BED DESIGN UNUSUALLY STRONG AND VIBRATION FREE** with greater bearing area to take downward thrust and greater resistance to deflection and twisting. Superior to conventional two-wall construction.
- **TOTALLY ENCLOSED GEAR BOX** powered from main spindle of headstock. Dial control to change gear without stopping or reducing spindle speed.

Why not take a good, critical look at your present lathes' performance? Write for new Sidney Lathe bulletins or for representative to call.

THE SIDNEY MACHINE TOOL CO.
SIDNEY, OHIO
Builders of Precision Machinery since 1904

Boring-Bar for Heavy Cuts

The Buck Tool Co., Kalamazoo, Mich., has announced a line of boring-bars of the design illustrated to provide greater rigidity for heavier, faster cuts with carbide tools. An adjusting screw on the side of the cutter provides easy adjustment to 0.0001 inch. Standard capacities range from 25/32 inch to 6 1/4 inches in the thirty sizes.

Circle Item 148 on postcard, page 229

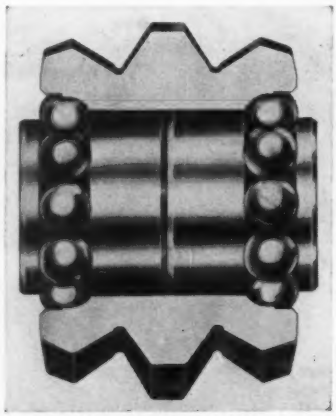
Milling Unit for Grooving Opposite Edges of Aluminum Stock

Special-purpose milling unit consisting basically of an individually designed base assembled with a standard feed having hydraulically controlled air cylinder, nonmetallic ways, and accordion protecting covers. Mounted on this unit is a standard vertical angle-plate with micrometer dial for correct vertical positioning of the two-speed 3600/1800-R.P.M., 10/5-H.P. motorized milling spindle equipped with a No. 50 NMTB nose. This unit is only one of many versatile variations of spindles, slides, and feeds for grinding, milling, boring, routing, or drilling offered by the Standard Electrical Tool Co., Cincinnati, Ohio. The unit shown is made in right- and left-hand assemblies for milling opposite edges of aluminum stock simultaneously.

Circle Item 149 on postcard, page 229

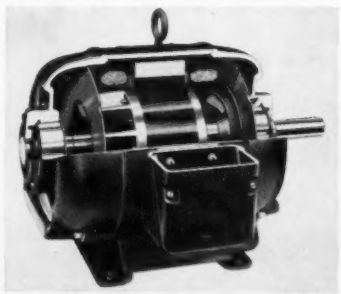
Roller-Tooth Ball Bearing for Steering Mechanism

Roller-tooth ball bearing manufactured by the Marlin-Rockwell Corporation, Jamestown, N. Y.,



for use in the manual steering mechanism of automobiles, trucks, and tractors. The profile of the bearing outer ring permits it to engage a worm-gear on the steering shaft. This type of bearing can be readily adapted to other applications. A complete line of standard dimension bearings is also available.

Circle Item 150 on postcard, page 229



Robbins & Myers Motor

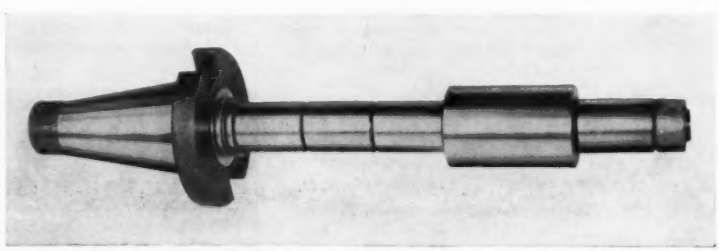
Re-rated motor of Series 254U line developed by Robbins & Myers, Inc., Springfield, Ohio, incorporating six improvements. This motor has been re-rated to conform with new NEMA requirements. Features include elimination of "hot spots" through straight-through, dual-sweep ventilation; tandem fans—one pushing and another pulling—to produce a washing action over the field coil ends to insure lower internal temperatures; full-height end-head protection; and internal baffles.

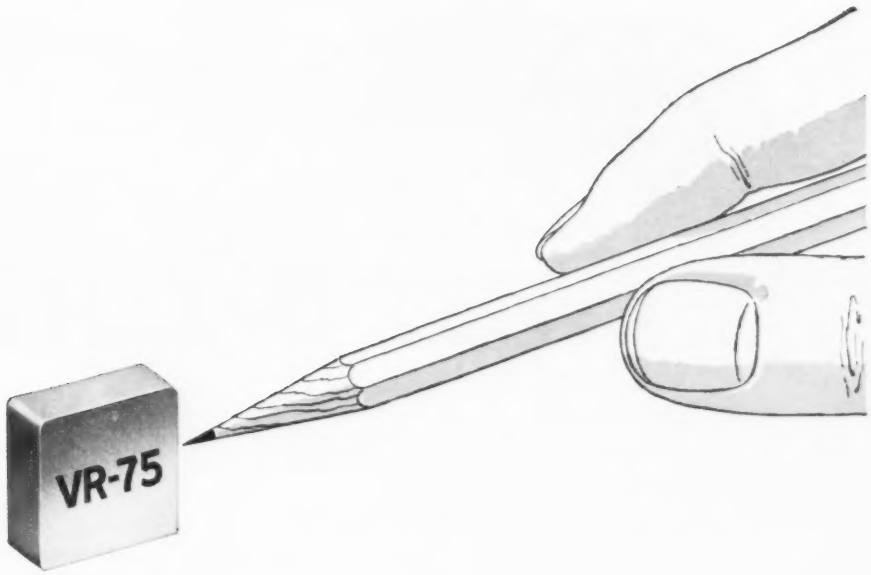
Circle Item 151 on postcard, page 229

Scully-Jones Milling Arbor

Improved milling arbor, designed to increase alignment accuracy and speed setting-up operations, announced by Scully-Jones & Co., Chicago, Ill. This arbor has a large end bearing surface and grooved end collar. Both the end surface and collar are larger in diameter than the spacers used on the arbor. This increased bearing surface eliminates cocking when the spacers and sleeves are snubbed up on the arbor. The grooved outer surface and larger size of the end collar make this arbor quickly identifiable by touch or eye. These new features are available on two styles of arbors. Style "A," used for light work and small cutters, is made in standard sizes from 7/8 inch to 1 3/4 inches. Style "B" is made in standard sizes from 7/8 inch to 2 1/2 inches for larger cutters and for use on machines with over-arm support.

Circle Item 152 on postcard, page 229





. . . a new Super Steel-Cutting Carbide Grade

field-proven on all types of work!

1½ to 2½ times greater tool life on crankshaft cheeking. Material SAE 1145 steel forging, 217-251 Brinell. Feed .013, SFPM 250. Toolholder with triangular full length insert. Severe interrupted cut.

Carbide	Insert life, average
Premium Grade "A"	125 pieces per corner
Premium Grade "B"	188 pieces per corner
VR-75	324 pieces per corner

81% greater tool life turning *Arma-steel forging*, 35-38 Rockwell C. Machine, Sundstrand automatic; feed .010; SFPM 400; depth of cut ⅛"—¼"; toolholder with triangular throw-away insert.

Carbide	Pieces Per Corner		
	Min.	Max.	Aver.
Premium Grade "B"	68	122	85
VR-75	115	211	160

Tool life doubled turning spline coupling. Machine, New Britain copy lathe; feed .020; speed 940 rpm; depth of cut 3/16". Negative rake toolholder with triangular throw-away insert.

Carbide	Pieces per corner
Premium Grade "B"	120 average
VR-75	240 average

4 to 1 tool life turning spline end of axle shaft. Machine, Bullard Man-Au-Trol; material SAE 1330 steel, 340-360 Brinell; speed 290 sfpm; feed .0133. Toolholder with triangular long insert.

Carbide	Pieces per corner	Edge Wear
Premium Grade "A"	45	.050
VR-75	187	.040

AVAILABLE NOW in throw-away and long inserts for negative rake toolholders. Ask for Bulletin No. 572.

Call your V-R representative or distributor or write.

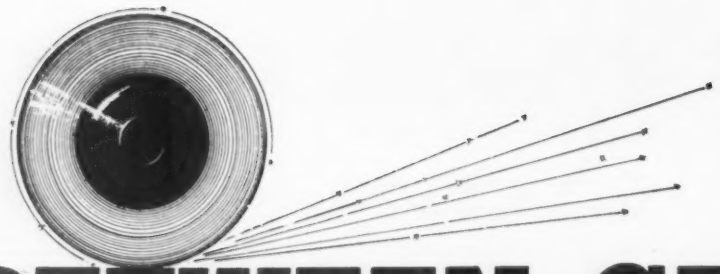
Vascoloy-Ramet Corporation

Subsidiary of Fansteel Metallurgical Corporation

834 S. Market St., Waukegan, Illinois

C-626

For more information fill in page number on Inquiry Card, on page 229



By E. S. Salichs

BETWEEN GRINDS

Somebody Has Got to Go

A public relations firm issued a news release about one of its clients and then followed up with a second bulletin beginning "Pardon us . . . but we 'goofed'." It went on to say that the first release contained some "descriptive innacurracies." That typist must sure be beautiful.

Job Jolt

An open letter from the manager of a large automobile service station to his employes: "Without infringing too much on the time usually devoted to lunch period, coffee breaks, rest period, storytelling, vacation planning, ticket-selling, and the rehashing of yesterday's TV programs, it is hoped that each employee will find some time that can be set aside, to be known as the Work Break. It is also hoped that those employes not in favor of adopting the Work Break plan will have fully completed their vacation plans."

Alarm Clocks?

The luggage of a Swiss clock importer recently gave customs officials a bad time at the New York International Airport. The radium dials on the timepieces set off a Geiger counter (used to detect atomic materials) to violent reaction.

Topsyturvy Topography

An upside-down map of the East Coast is available—Florida at the top, New England at the bottom, the idea being that motorists need not reverse the map while driving south. This may mean, however, that a person with a poor sence of direction will drive up to Plymouth Rock in search of the Fountain of Youth.

Auto Lingo

Automobile workers, as in other trades, have their own terms in referring to certain parts. For example, sergeant's stripes mean diagonal pieces of trim; egg crates stand for grilles; and spaghetti is the word for the compound injected to seal points ere welding.

Extraordinary Thing—It's Ordinary String

More than fifty years ago, Orville and Wilbur Wright tied a piece of string to their primitive planes in order to find out the angle of flight and whether their direction was true. Today, according to *Planes* (publication of Aircraft Industries Association, Inc.), Air Defense Command pilots are doing the same thing on their faster-than-sound aircraft to determine whether their flight is along the intended path.

UNDER COVER STORY—Traveling westward on the High Seas as this is written, is the Mayflower II, replica of the historic sailing ship. On board is a cargo of treasure chests, each the exhibit of a British manufacturer, carried out in the spirit of 1620. Should we have the opportunity of viewing the ship upon its arrival, there is one chest we would open with particular interest, the reason being that our publisher's English affiliate, the British Machinery Publishing Co., Ltd., had a hand in it, so to speak. The chest contains engineering products of the Talbot Tool Co., and our affiliates produced the two parchment-like manuscripts seen here and fixed under the lid. Sheet metal was sprayed to look like parchment, the art work was done in Old English script, and seals were made of imitation sealing wax, thus achieving protection from the elements and souvenir hunters

DIAL CONTROL OF SPINDLE SPEEDS AND TURRET TOOL FEEDS ...

gives you maximum productivity with new 1⅜" and 1⅝" Model AB

CLEVELAND DIALMATICS

Cleveland brings to metalworking another major advancement in single spindle bar automatic machine design! Now, by making *dial settings* on the control panel, you preselect the *exact* forward and reverse tool feed——and the *exact* forward and reverse spindle speed—for each of five working turret tools. Each tool is completely and individually controlled throughout the cycle . . . *tuned* for maximum cutting efficiency!

There are *no change gears*. Spindle speeds are electronically controlled and infinitely variable between 40 and 3200 r.p.m. You can preselect and set 10 different spindle speeds for each machine cycle. Spindle speed changes and reversals are entirely automatic and are made through electric clutches, which make the number of changes or reversals per minute practically unlimited.

A few of many modern features of these new Clevelands are listed at left. It will pay you to get full information. Get in touch with a Cleveland sales engineer. He'll give you the full story on the many economies these new Clevelands can bring to your plant.

Specifications and Major Features of 1⅜" and 1⅝" Model AB CLEVELAND DIALMATICS

	1⅜" Model AB	1⅝" Model AB
Max. Round Bar	1⅜"	1⅝"
Max. Hex. Bar	1 3/16"	1 13/32"
Max. Square Bar	31/32"	1⅛"
Horsepower	7½	7½
Idle Motion Time	6.3 secs.	6.3 secs.
Stock Feed Stroke	9"	9"
Turning Length	4⅞"	4⅞"
Dia. Tool Circle	9"	9"
No. Turret Holes	5	5
Cross Slide Travel	4"	4"
Cross Slide Tooling Width	6 1/16"	6 1/16"

Infinitely variable spindle speeds.
Spindle speed range—40 to 3200 R.P.M.
Cleveland exclusive quick change collet.
Quick change feedshell pads which require no screws.
Variable tool feeds through electric feed drive.
High speed Geneva turret index.
Flame hardened double cross slides.
Quick hand crank stock feed adjustment.
Universal camming and easily adjustable cam drums.

Write for new 1⅜" and 1⅝" Model AB Bulletin

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information fill in page number on Inquiry Card, on page 229

News OF THE INDUSTRY

Illinois and Wisconsin

JOHN CATTANACH, JR., has been appointed manager of sales of tubular products and cold-finished steel bars at the Buffalo plant of Joseph T. Ryerson & Son, Inc. Before joining Ryerson in 1933, Mr. Cattanach was associated with the Genesse Bridge Co. He was engaged in general sales work in the office until his appointment as field representative in 1941. He remained in this capacity until his promotion to the managerial post.

John Cattanach, Jr., sales manager, tubular products and cold-finished bars, Joseph T. Ryerson & Son, Inc.

ROBERT W. HOEFLER has been appointed assistant sales manager of Verson Allsteel Press Co., Chicago, Ill. Mr. Hoefler has been associated with the company since 1950. Prior to his recent appointment he served in the capacities of cost accountant and sales engineer.

JOHN J. FAJNOR has been elected a vice-president of Brad Foote Gear Works, Inc., Chicago, Ill. Mr. Fajnor was formerly a sales engineer and plant manager of the company's Lemont, Ill., division, the American Gear & Mfg. Co.

JOHN I. ROSS, JR., has been appointed sales and engineering representative in Central Illinois for the Michigan Tool Co., Detroit, Mich. His business office is at 211 Commercial National Bank Bldg., Peoria, Ill.

THOR POWER TOOL CO., Chicago, Ill., has moved its Houston, Tex., office to new and larger quarters at 5503 Lawndale Ave.

WARNER ELECTRIC BRAKE & CLUTCH CO., Beloit, Wis., announces the following appointments: WESLEY TIMMCKE has been named manager of engineering and ROGER H. BROWN, sales manager of the company's Industrial Division. At the same time, it was announced that SAMUEL HARRIS & CO., INC., 114-116 N. Clinton St., Chicago, Ill., has been appointed a distributor for the Industrial Division.

Michigan and Indiana

SNYDER TOOL & ENGINEERING CO., Detroit, Mich., announces the following appointments: LEO P. GAJDA was named vice-president of engineering and BRUCE M. REGAN, vice-president of manufacturing. Mr. Regan has been with the company for twenty-seven years. In 1950, he was named manufacturing manager, a position he held prior to his new appointment. Mr. Gajda joined the company in 1934 and has been a director of engineering since 1951.

FRITZ WALTERS has been named sales and service manager of the Detroit Tap & Tool Co., Base Line, Mich. WILMO WEEVIE has been named assistant sales manager. Both men have been with the company for twenty-two years.

Minnesota

WM. K. NELSON CO., 807-13th Ave. South, Minneapolis, has been appointed machine tool representative in Minnesota and northwest Wisconsin for Kurt Orban Co., Inc., Jersey City, N. J.

SATTERLEE CO., 2200 E. Franklin Ave., Minneapolis, Minn., has been appointed distributor for the Niagara Machine & Tool Works in Minnesota and northwestern Wisconsin.

JAMES S. LOCKE has been named manager of operations for the Minneapolis-Regulator Co.'s commercial division activities in Minneapolis, Minn.

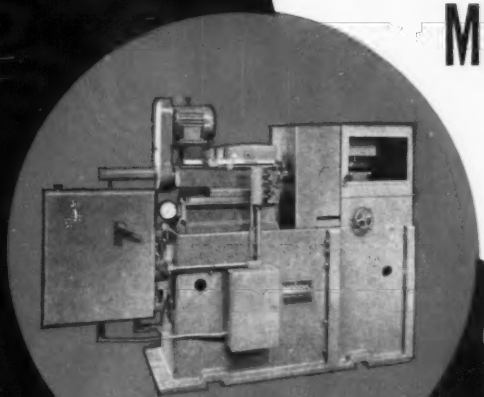
New England

DONALD C. CAMPBELL has been appointed works manager of the Skinner Chuck Co., New Britain, Conn. He will be responsible for manufacturing operations in the company's chuck and electric valve divisions.

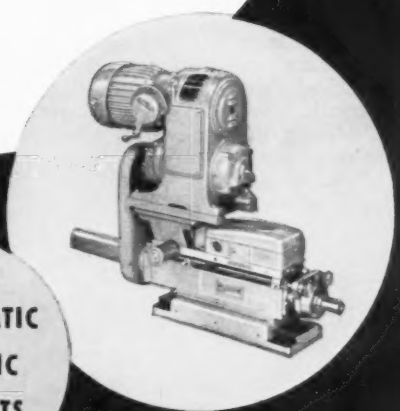
(Left) Leo P. Gajda, vice-president of engineering; and Bruce M. Regan, vice-president of manufacturing, Snyder Tool & Engineering Co.

NEW

Morris GUN DRILLING MACHINES

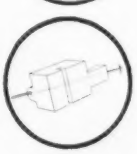


equipped with . . .



AIR-OIL-MATIC AUTOMATIC DRILL UNITS

increases efficiency and ease of production for parts like these:



- Deep holes 1/8" diameter and up.
- Deep holes located off-center.
- Deep holes in out-of-balance parts.
- Deep holes in irregular shaped parts.

ALSO • Shallow holes where accuracy and finish are critical.

- Speed drilling with high rate of metal removal.

Never before, have all these advantages for gun drilling been offered in one unit, creating a wide new range of applications in automatic high production.

- **ADJUSTABLE AUTOMATIC LOAD CONTROL** . . . automatically detects dull or chipped drills, hard spots, insufficient coolant . . . assures protection of gun drills, parts and fixtures.
- **6 OR 9 INCH STROKE**
- **INFINITELY VARIABLE SPEEDS AND FEEDS** . . . speeds up to 8000 rpm . . . feeds up to 40" per min.
- **COMPLETE COORDINATED HIGH PRESSURE COOLANT AND CHIP REMOVAL SYSTEM**

write today for additional information

Builders of MOR-SPEED Tools

Morris

THE MORRIS MACHINE TOOL CO.
946 HARRIET STREET
CINCINNATI 3, OHIO

For more information fill in page number on Inquiry Card, on page 229

(Left) Edwin J. Keyes, vice-president and works manager; and Raymond A. St. John, vice-president and general sales manager of Heald Machine Co.

HEALD MACHINE CO., Worcester, Mass., announces the election of two officers: EDWIN J. KEYES was elevated from works manager to vice-president and works manager. RAYMOND A. ST. JOHN was promoted from general sales manager to vice-president and general sales manager. Mr. Keyes has been with the company for ten years.

VAN NORMAN INDUSTRIES, INC., Springfield, Mass., announces removal of its main office to 6 Church St., New York City.

BROWN & SHARPE MFG. CO., Providence, R. I., announces the following appointments: RONALD E. STENNING was named director of education and GEORGE N. LEVESQUE became director of research.

New York and New Jersey

KELLER MACHINERY CO., 1807 Elmwood Ave., Buffalo, N. Y., has been appointed exclusive agent for Buffalo, Rochester, and western New York State by the Cleveland Punch & Shear Works Co., Cleveland, Ohio.

UNION CARBIDE AND CARBON CORPORATION, New York City, has shortened its name to Union Carbide Corporation. At the same time, the following executive appointments were announced. A LYNDON FOSCUE, BIRNY MASON, JR., and EDWIN B. SUYDAM were elected vice-presidents and appointed members of the Appropriations Committee. Mr. Foscue has been with the company since 1924. Mr. Mason joined in 1932, and Mr. Suydam, in 1916.

OLIN REVERE METALS CORPORATION, New York City, has changed its name to ORMET CORPORATION. It is jointly owned by Olin Mathieson Chemical Corporation and Revere Copper and Brass, Inc.

LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, New York City, will now be known as Linde Company, Division of Union Carbide Corporation.

JOHN B. GIRDLER has been appointed commercial vice-president in charge of sales, Vanadium Corporation of America, New York City.

Industrial and steel sales office of the TIMKEN ROLLER BEARING CO. is being moved to a new building at 2960 Main St., Buffalo, N. Y.

ROBERT MCNEAL SMITH has been appointed vice-president in the sales organization of Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y.

PEARSE-DENGEL TOOL CO., Hasbrouck Heights, N. J., has been appointed distributor for the Engis Equipment Co., Chicago, Ill., in the metropolitan New York area.

Ohio

E. W. BLISS CO., Canton, Ohio, announces the following appointments: WILLARD F. ROCKWELL, JR. and PETER M. FLANIGAN have been elected directors. Mr. Rockwell is president of the Rockwell Mfg. Co. and also a director of Rockwell Spring & Axle Co.; Servel, Inc.; Na-

Fabian Bachrach

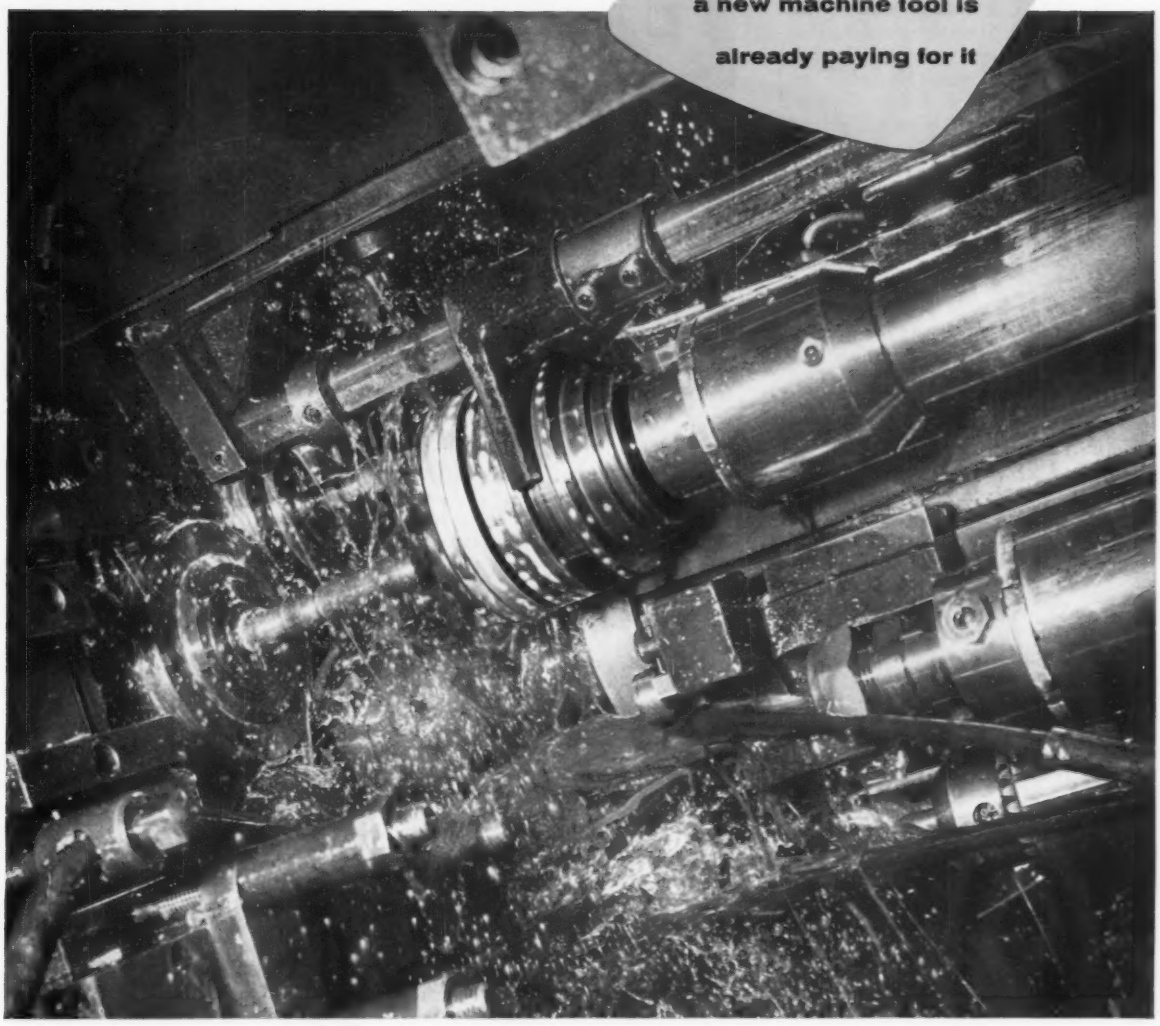
Fabian Bachrach

Fabian Bachrach

(Left to right) A. Lyndon Foscue, Birny Mason, Jr., and Edwin B. Suydam newly elected vice-presidents and members of the Appropriations Committee of Union Carbide Corporation

JONES & LAMSON
THREAD TOOLS

the man who needs
a new machine tool is
already paying for it



J & L Revolving Tangent Die Heads Give Long-Run Economy, Guaranteed Accuracy

The efficiency of your threading operations rises sharply when you use J & L automatic opening Tangent Die Heads. Revolving types, similar to that illustrated, are available for multi-spindle automatics, drill presses and special machines.

Chasers are changed in mere seconds, without disturbing the die head *or chaser holders;* repetitive tripping permits automatic threading close-to-shoulder; one set of holders handles a full range of coarse, fine and multiple pitches; you get up to 30 foolproof resharpenings with every set of chasers. *And* Class III threads are guaranteed... *every time!*

J & L manufactures complete lines of die heads and chasers; accessories and sharpening equipment; collapsible and solid adjustable taps and chasers; the "Modern-Magic" chuck and automatic releasing stud setters. Send for Thread Tool Catalog. JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 229

tional Union Fire Insurance Co.; and many other corporations. Mr. Flanigan is vice-president of Dillon, Read & Co., Inc., and a director of Belding, Heminway Co., Inc. At the same time, it was announced that CHARLES H. SCHWERIN had been appointed manager of West Coast sales for the Mackintosh-Hemphill and Rolling Mill Division. His office will be at the company's branch plant in San Jose, Calif.

MOTCH & MERRYWEATHER CO., Cleveland, and AVEY DRILLING MACHINE CO., Cincinnati, Ohio, announce the merger of both companies. The Avey company will henceforth be known as the Avey Division of Motch & Merryweather Machinery Co. and will operate as a separate unit, retaining its present facilities, management, and personnel. The Cleveland plants of Motch & Merryweather will provide increased total facilities, especially for assembly and heavy machining operations.

DENISON ENGINEERING DIVISION, American Brake Shoe Co., Columbus, Ohio, announces the following executive promotions: PAUL W. NORRIS was appointed vice-president and general manager, and DENISON NEALE was promoted to director of sales. At the same time, it was announced that LEROY E. BONNETTE was named chief engineer and CARL W. LINDAHL, director of purchasing.

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, announces the following appointments: RICHARD A. GEUDER has been named general manager—marketing, and CARL V. GREGORY became sales manager. Mr. Geuder has been general sales manager for the past year, and Mr. Gregory has been manager of district sales since 1954.

ROBERT E. MCKEE has been appointed training director of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Mr. McKee was formerly associate professor of mechanical engineering at University of Michigan.

JOHN G. FRISCHKORN has been appointed assistant sales manager of the Cleveland Tramrail Division of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

THEMIS C. PAILAS has been appointed regional sales manager in the Cleveland, Ohio, district office of Heli-Coil Corporation, Danbury, Conn.

(Left) George H. Acker, president; and Howard Dingle, chairman of the board of Cleveland Worm & Gear Co. and the Farval Corporation

CLEVELAND WORM & GEAR CO. and its affiliate, the Farval Corporation, Cleveland, Ohio, announce the election of GEORGE H. ACKER as president and HOWARD DINGLE as chairman of the board of both companies. All other officers were reelected, including WILLIS W. CLARK, vice-president. Before his election to the presidency, Mr. Acker held the post of executive vice-president, and Mr. Dingle, as president. Mr. Dingle has been with the company since 1924; Mr. Acker, since 1923.

HYDRAULIC PRESS MFG. CO., a division of Koehring Co., Mount Gilead, Ohio, announces the following promotions: WILLIAM J. FATH was named works manager and WARREN E. BECK succeeds Mr. Fath as production control manager. A. L. WALLACE was named assistant production control manager.

OHIO CRANKSHAFT CO., Cleveland, Ohio, announces two executive appointments: H. J. LOUTH was named works manager of the company's Crankshaft and Camshaft Division, and BEN M. KOZMAN was promoted to personnel director. Mr. Louth joined the company in 1942 as an industrial engineer. Mr. Kozman has been with the company since 1947.

PRODUCTO CORPORATION announces the opening of a die set assembly warehouse at 136200 Enterprise Ave., Cleveland, Ohio, to provide service for northeastern Ohio, western Pennsylvania, part of western New York, and all of West Virginia.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces the following appointments: HAYWARD A. GAY was named manager of the Machine Tool Division, and PHILIP O. GEIER, JR., was named manager of the Products Division.

BRUSH ELECTRONICS CO., Cleveland, Ohio, announces the establishment of a factory branch office in Los Angeles, Calif. The new offices are at 1960 S. LaCienega Blvd.

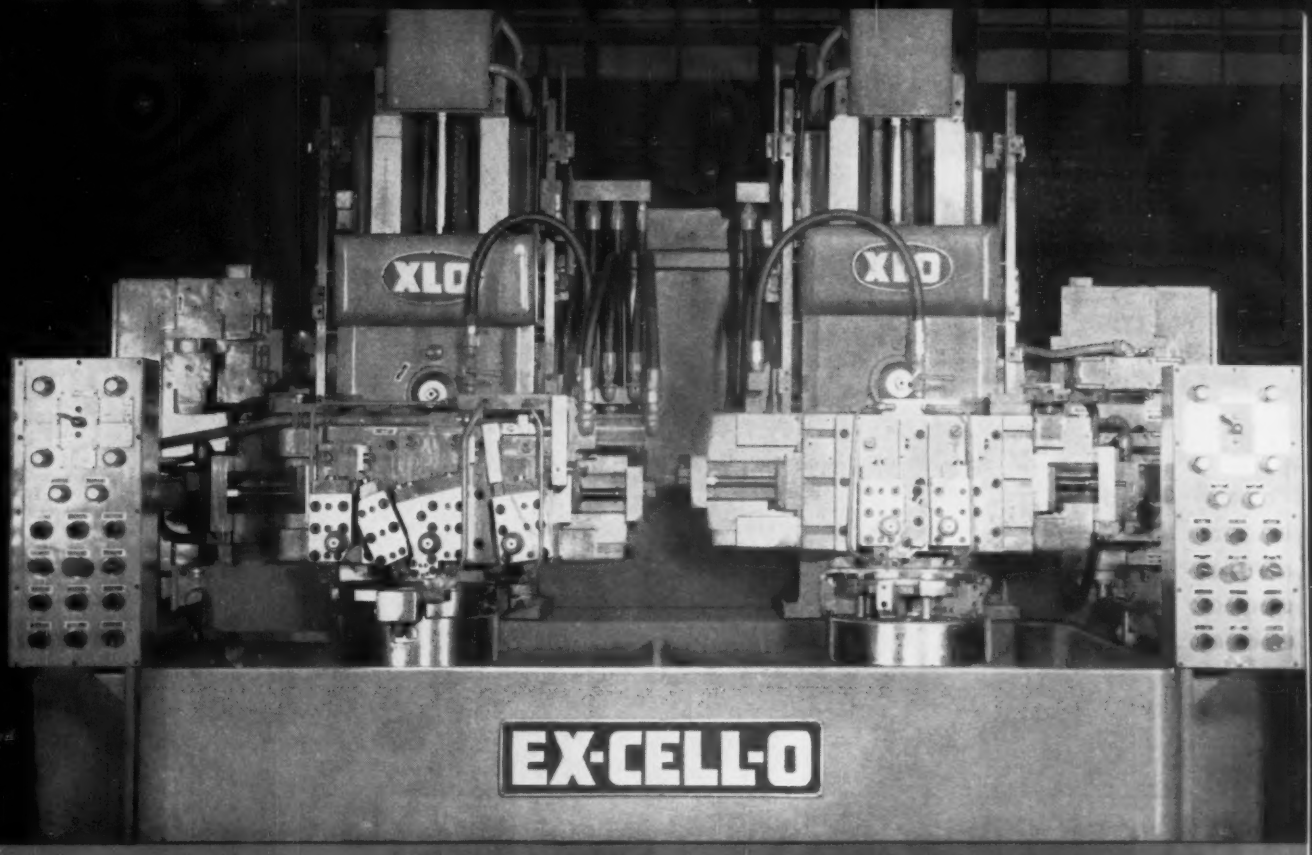
CLEARING MACHINE CORPORATION, division of U. S. Industries, Inc., announces the opening of a new office at 1513 Jefferson St., Toledo, Ohio.

Pennsylvania and Maryland

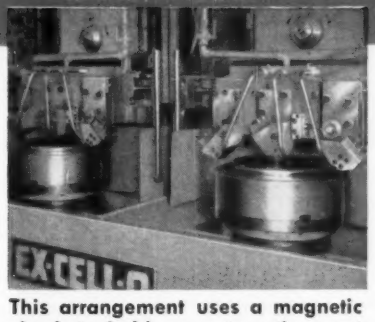
BALDWIN-LIMA-HAMILTON CORPORATION, Philadelphia, Pa., announces the following appointments: CHARLES FREUNDLICH has been appointed sales engineer for the New England area; NORMAN C. PESKIN will represent the Electronics & Instrumentation Division as sales engineer on SR-4 devices and systems in New England; RICHARD F. TRIMBACH was appointed southwestern field sales engineer. He will maintain headquarters at the company's district office, 600 St. Paul St., Los Angeles, Calif., and will represent the company's Loewy-Hydropress Division in Southern California, Arizona, New Mexico, and the city of Denver.

YALE MATERIALS HANDLING DIVISION, Yale & Towne Mfg. Co., Philadelphia, Pa., announces the following appointments: ROGER R. REYNOLDS was named district sales manager for the Texas, Oklahoma, and Louisiana territory. L. PATRICK

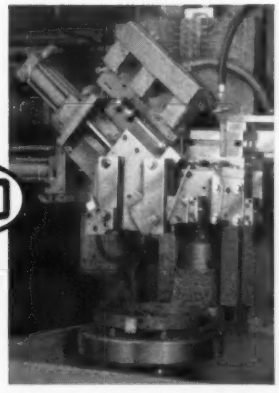
(Continued on page 252)



Twin spindles Double work capacity



This arrangement uses a magnetic chuck to hold an automotive part for processing.



XLO

EX-CELL-O FOR PRECISION

The Style 432 machine as fitted with an auxiliary slide for angular cuts.

A single operator on this Ex-Cell-O Vertical can precision turn, bore, face, groove and chamfer two identical or completely different workpieces simultaneously. All operations may be performed singly or in combination, and don't overlook the loading ease and tool accessibility of this vertical boring machine.

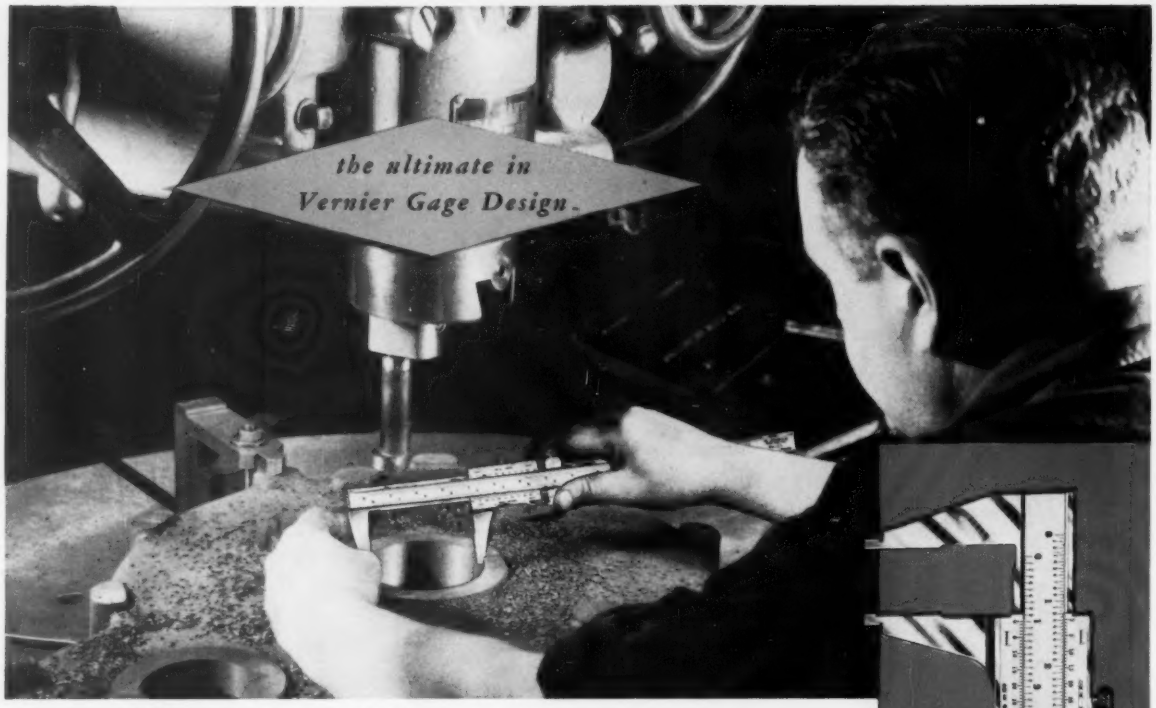
Ex-Cell-O engineers have cut maintenance time to barest minimum by locating service parts within easy reach. Yet overall design of this machine is clean and compact.

No doubt you are interested in increasing your production output. Call your nearby Ex-Cell-O representative for a conference today. His suggestions cost you nothing—and may save you a considerable sum. Or get in touch with Ex-Cell-O in Detroit directly. We would appreciate the opportunity of putting our years of specialized experience in the machine tool field at your disposal.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

57-20

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING & BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS & BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT & MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



New Starrett No. 123 *Satin Chrome*
MASTER-VERNIER CALIPER

Here is a new Vernier caliper that can be used with supreme confidence in its master precision . . . a gage with Starrett no-glare *Satin Chrome Finish* for easy reading and rust and stain resistance . . . with new, long 50-division Vernier scales for simplified setting and error-proof reading without a magnifying glass . . . with new flush fitting Vernier scales to eliminate parallax errors . . . with new open-face design which provides both inside and outside Vernier scales on the same side of the tool — you hold and read it exactly the same for all measurements.

If you take pride in the precision standards of your shop, you'll want the new Starrett No. 123 MASTER-VERNIER Caliper . . . for its positive precision, error-proof design and lifetime accuracy.

Your Industrial Supply Distributor will gladly demonstrate its many outstanding new features . . . or send for descriptive folder.

NO OTHER VERNIER GAGE GIVES YOU ALL THESE STARRETT FEATURES

SATIN CHROME FINISH — no-glare, easy reading, long wearing, rust and stain resisting.

NEW LONG VERNIERS with widely spaced graduations for easy setting and reading.

FLUSH FITTING VERNIER PLATES to eliminate optical reading errors.

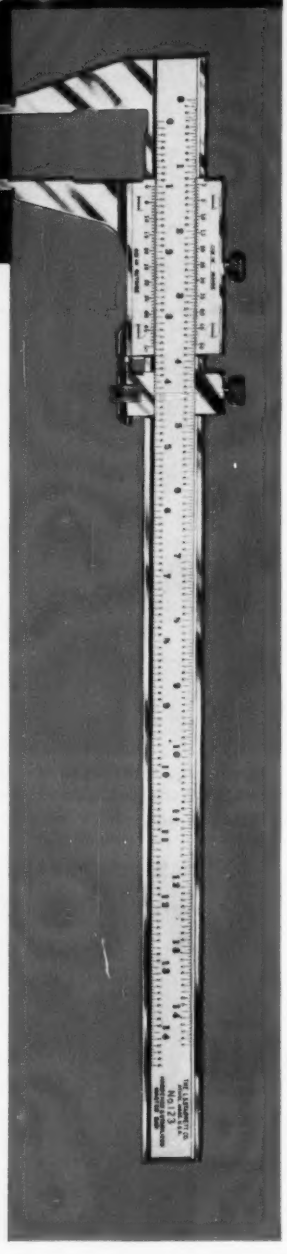
OPEN-FACE DESIGN with inside and outside scales on the same side — no need to turn the tool.

HARDENED, STABILIZED master bar for maximum rigidity, resistance to wear, lasting accuracy.

EXTRA LONG ADJUSTING JAW for greater bearing surface to assure perfect squareness.

NEW JAW DESIGN for greater rigidity and resistance to springing.

12- AND 24-INCH SIZES graduated in thousandths to read the full 12- or 24-inch length.



BIG NEW CATALOG NO. 27

Describes and illustrates the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

Starrett

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

For more information fill in page number on Inquiry Card, on page 229

AMERICAN STANDARD FORMULAS FOR BOLT, CAP-SCREW, AND SET-SCREW HEADS

PRODUCT	WIDTH ACROSS FLATS		HEIGHT OF HEAD	
	BASIC [1]	TOLERANCE (Minus)	NOMINAL [2]	TOLERANCE (Plus or Minus)
Regular Square Bolt	1½D	0.050D	⅔D	0.016D + 0.012
Regular Hexagon Bolt	Size: ¼ — Width: 1½D + 1/16 5/16 to 4 — 1½D	0.050D	Size: ¼ to 7/16 — Height: ⅝D + 1/64 ½ to ⅞ — ⅝D + 1/32 1 to 1⅞ — ⅝D + 1/16 2 to 3¾ — ⅝D + ⅛ 4 — ⅝D + 3/16	Plus tolerance only 0.016D + 0.012 Minus tolerance adjusted so that minimum head height is same as minimum head height of regular semi-finished hexagon bolt.
Regular Semi-Finished Hexagon Bolt	¼ — 1½D + 1/16 5/16 to 4 — 1½D	0.050D	¼ to ⅞ — ⅝D 1 to 1⅞ — ⅝D − 1/64 2 to 2¾ — ⅝D − 1/32 3 — ⅝D 3¼ to 3¾ — ⅝D − 1/16 4 — ⅝D	Size: ¼ to 1 — Tolerance: 0.015D + 0.003 1⅛ to 4 — 0.016D + 0.012
Finished Hexagon Bolt Hexagon Head Cap Screw	¼ — 1½D + 1/16 5/16 to 3 — 1½D	Size: ¼ to ⅝ — Tolerance: 0.015D + 0.006 ¾ to 1 — 0.025D + 0.006 1⅛ to 3 — 0.050D *(Note: For Finished Hexagon Bolts in sizes ¼ to 1 in. tolerance may be 0.050D when product is hot made.)*	Same as for Regular Semi-Finished Hexagon Bolt	Same as for Regular Semi-Finished Hexagon Bolt
Heavy Hexagon Bolt	1½D + ⅛	0.050D	⅝D + 1/16	Plus tolerance only 0.016D + 0.012 Minus tolerance adjusted so that minimum head height is same as minimum head height of heavy semi-finished hexagon bolt.
Heavy Semi-Finished Hexagon Bolt Finished Heavy Hexagon Bolt	1½D + ⅛	0.050D	½ to ⅞ — ⅝D + 1/32 1 to 1⅞ — ¾D 2 to 3 — ⅞D − 1/16	0.016D + 0.012
Lag Bolt	Same as Regular Square Bolt	Same as Regular Square Bolt	Same as Regular Square Bolt	Same as Regular Square Bolt
Set Screw	D	#10 to 5/16 — *(See Table)* ⅜ to 1½ — 0.020D + 0.006	½D	0.020D + 0.004

All dimensions given in inches.
[1] Adjusted to sixteenths.
[2] ¼ to 1 in. sizes adjusted to sixty-fourths.
1⅛ to 2½ in. sizes adjusted upward to thirty-seconds.
2¾ to 4 in. sizes adjusted upward to sixteenths.

D = Nominal bolt size.
W = Width across flats.

WIDTH ACROSS CORNERS

SQUARE

For all square bolt heads, max. width across corners equals 1.4142 × W (max.) and min. width across corners equals 1.373 × W (min.).

HEXAGON

For all hexagon bolt heads, max. width across corners equals 1.1547 × W (max.) and min. width across corners equals 1.14 × W (min.).

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD FORMULAS FOR NUTS—1

TYPE OF NUT	WIDTH ACROSS FLATS				THICKNESS OF NUT			
	BASIC[1]		TOLERANCE (Minus)		NOMINAL[2]		TOLERANCE (Plus or Minus)	
	Size	Width	Size	Tolerance	Size	Thickness	Size	Tolerance
Finished Hexagon Finished Hexagon Slotted	¼ ⅝ to 3	1½D + ⅛ 1½D	¼ to ⅝ ¾ to 3	0.015D + 0.006 0.050D	¼ to ⅝ ¾ to 1⅜ 1¼ to 2 2¼ to 3	7/8D 7/8D − 1/64 7/8D − 1/32 7/8D − 3/64	¼ to ⅝ ¾ to 3	0.015D + 0.003 0.016D + 0.012
Finished Hexagon-Jam	¼ ⅝ to 3	1½D + ⅛ 1½D	¼ to ⅝ ¾ to 3	0.015D + 0.006 0.050D	¼ to ⅝ ¾ to 1⅜ 1¼ to 2 2¼ 2½ to 3	*(See Table)* ½D + 3/64 ½D + 1/32 ½D + 5/64 ½D + 13/64	¼ to ⅝ ¾ to 3	0.015D + 0.003 0.016D + 0.012
Finished Hexagon Thick Finished Hexagon Thick Slotted Finished Hexagon Castle	¼ ⅝ to 1½	1½D + ⅛ 1½D	¼ to ⅝ ¾ to 1½	0.015D + 0.006 0.050D	*(See Table)*		0.015D + 0.003	
Regular Square Regular Hexagon	¼ to ⅝ ¾ to 3	1½D + ⅛ 1½D	0.050D		7/8D		0.016D + 0.012	
Regular Hexagon-Jam	¼ to ⅝ ¾ to 3	1½D + ⅛ 1½D	0.050D		¼ to 7/16 ½ to 1⅜ 1¼ to 2¼ 2½ to 3	½D + 1/32 ½D + 1/16 ½D + ⅛ ½D + ¼	0.016D + 0.012	
Regular Semi-Finished Hexagon Regular Semi-Finished Hexagon Slotted	¼ to ⅝ ¼ to 3	1½D + ⅛ 1½D	0.050D		¼ to 1⅜ 1¼ to 2 2¼ to 3	7/8D − 1/64 7/8D − 1/32 7/8D − 3/64	0.016D + 0.012	
Regular Semi-Finished Hexagon-Jam	¼ to ⅝ ¼ to 3	1½D + ⅛ 1½D	0.050D		¼ to 7/16 ½ to 1⅜ 1¼ to 2 2¼ 2½ to 3	½D + 1/64 ½D + 3/64 ½D + 1/32 ½D + 5/64 ½D + 13/64	0.016D + 0.012	
Machine Screw Stove Bolt	#0 to #12 ¼ to ⅜	*(See Table)* 1½D + ⅛	*(See Table)*		*(See Table)*		*(See Table)*	

All dimensions given in inches.
[1] Adjusted to sixteenths.
[2] Adjusted to fractions.
D = Nominal nut size.
W = Width across flats.

Width Across Corners

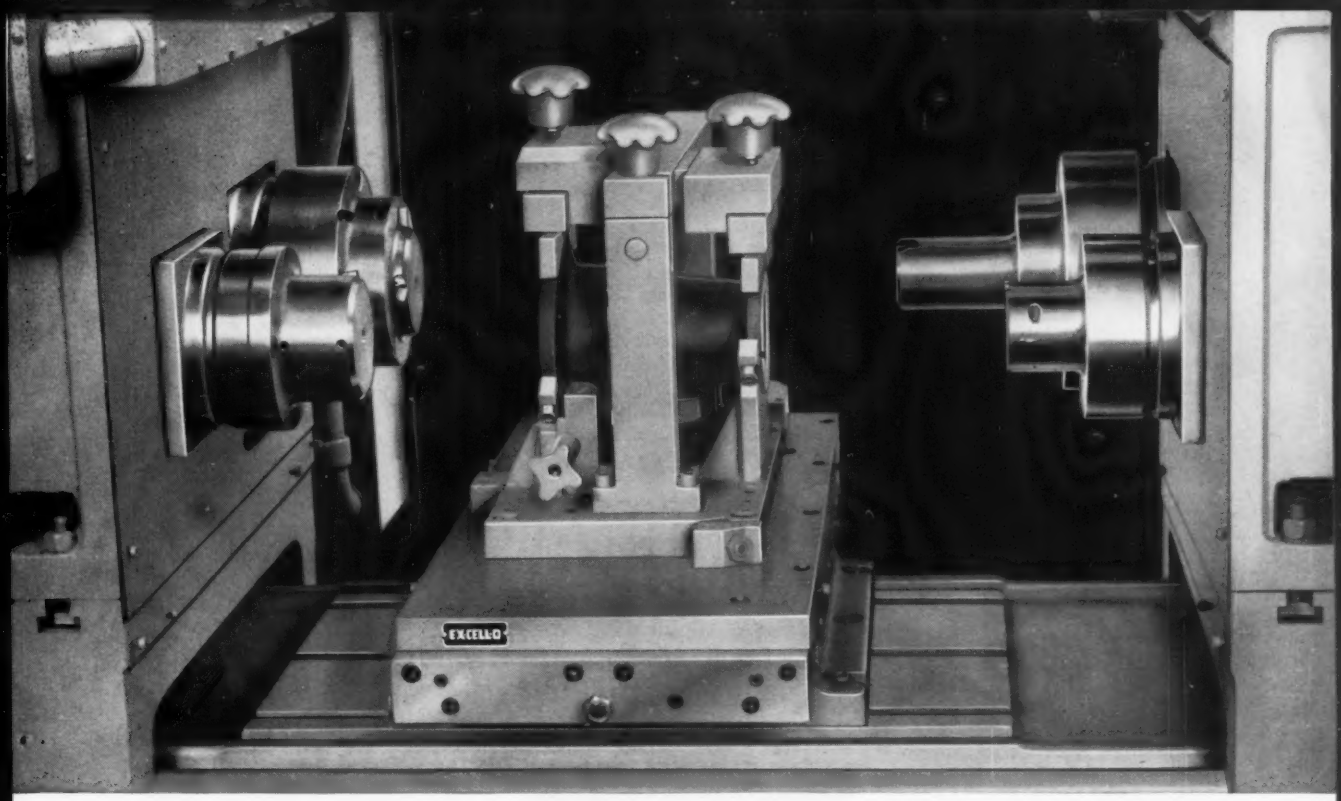
SQUARE

For all square nuts, max. width across corners equals 1.4142 × W (max.) and min. width across corners equals 1.373 × W (min.)

HEXAGON

For all hexagon nuts, max. width across corners equals 1.1547 × W (max.) and min. width across corners equals 1.14 × W (min.)

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.



One of several fixture arrangements used for machining valve parts.

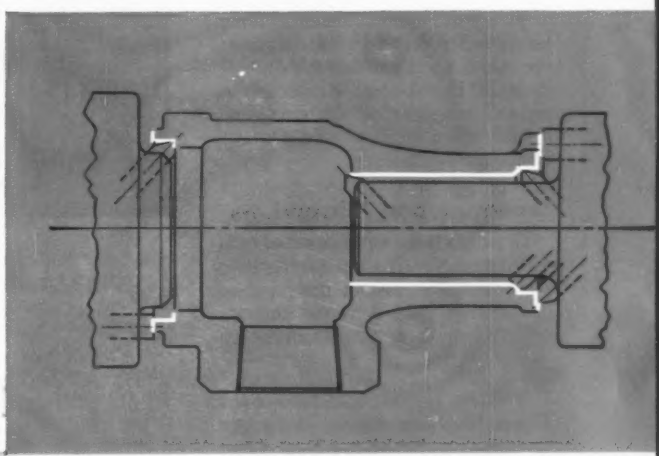
Fast and Flexible

SHORT RUN COST SAVER . . .

This Ex-Cell-O 17-A Precision Boring Machine rough bores, plunge faces, finish bores and chamfers a wide range of assorted cast-iron valve bodies and bases. Production schedules require relatively short runs of each size, so the tooling shown here has set blocks to accommodate the various parts.

Designed for medium and large size workpieces, the double-end 17-A Precision Boring Machine can handle identical operations at either end; rough at one end, finish at the other; or perform an entirely different operation at each end. So you can see the cost-saving versatility of this two-in-one machine.

Perhaps slow changeovers are inflating your production costs. If so, why not call your Ex-Cell-O Representative or contact Ex-Cell-O in Detroit.



White lines represent cuts made on a typical part.

Here are a few sizes of the valve bodies and bases processed on the Style 17-A Machine.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

XLO EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-22

McGAULEY will be the sales representative in New Orleans, where a new second district office is being opened.

ALCO PRODUCTS, INC. has moved its Pittsburgh, Pa., district office from the downtown area of the city to the suburbs. The new location is at Greentree and Cochran Roads, in the suburban South Hills section of Scott Township.

ROCKWELL MFG. CO., Pittsburgh, Pa., announces that HERMAN GOTTWALD and DONALD C. MORGAN have been named assistant vice-presidents and production managers of the company's Meter and Valve Division.

WILLIAM E. MULLESTEIN has been named vice-president—administration of the Lukens Steel Co., Coatesville, Pa. He will be in charge of sales, operations, and purchasing.

HOWARD W. MERRILL, director of operations at the Martin Baltimore Division, has been named a vice-president of the Martin Co. and general manager at Baltimore, Md. He succeeds WILLIAM B. BERGEN, who retains his position as executive vice-president. Mr. Merrill joined the company in 1946.

BLACK & DECKER MFG. CO., Towson, Md., announces the appointment of JAMES W. CHARBONNIER as director of industrial and plant engineering. Announced also was the appointment of DRUMMOND R. STUART as general manager of the company's branch office in Brockville, Ontario, Canada.

Tennessee and Missouri

OLIN MATHIESON CHEMICAL CORPORATION, New York City, has completed negotiations for the purchase of the assets of SOUTHERN ELECTRICAL CORPORATION, Chattanooga, Tenn.

NOLAND CO., INC., Chattanooga, Tenn., has been appointed a representative of Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. G. T. RICHARDSON is manager.

HENRY DISSTON and VULCAN CRUCIBLE STEEL DIVISIONS of H. K. Porter Co., Inc., have appointed Cutting Tools, Inc., 624 N. Skinker Ave., St. Louis, Mo., as distributors for their products in the St. Louis area.

PETERSON WELDING LABORATORIES, INC., Kansas City, Mo., announces the appointment of P. J. PARKER as vice-president and general manager following the recent merger of Parker-McKnight Co., Cincinnati, Ohio, with the Peterson organization.

JONATHAN KLUDT has been elected executive vice-president and general manager of the Lincoln Engineering Co., St. Louis, Mo., division of the McNeil Machine & Engineering Co., Akron, Ohio. Mr. Kludt has been with the company since 1934.

Obituaries

Wendell E. Whipp

Wendell E. Whipp, chairman of the board of the Monarch Machine Tool Co., Sidney, Ohio, died on April 27 at the age of seventy-three

Moffett Studio

years. Born near Dayton, Mr. Whipp received his early schooling there and attended Ohio State University. His first job, in 1905, was in the sales and advertising departments of the National Cash Register Co. In 1912, then sales manager of the Columbus territory for NCR, he took over the management of Monarch—a concern employing twenty-five men. For years, Mr. Whipp was the salesman, purchasing agent, office manager, and consulting engineer. As president (1931-1947) and subsequently as chairman of the board, he helped to build Monarch into the large producer of engine toolroom lathes it has become. Mr. Whipp was also active in the metalworking industry, serving a term (1938-1939) as president of the National Machine Tool Builders' Association.

WILLIAM LaCOSTE NEILSON, vice-president and former director of Norton Co., died on March 5. During his fifty years with Norton, Mr. Neilson either helped establish or manage nearly all of the company's plants in Australia, Canada, England, France, Germany, and Italy. He was responsible for investigating new sources of bauxite and negotiating for supplies of industrial diamonds. One of Norton's two vice-presidents elected in 1929, he was a director of the company from 1921 to 1945. Since 1941, he had also been consultant for the United States Treasury Department, United States Department of Agriculture, and a member of the Munitions Board.

CHARLES C. CHEYNEY, vice-president in charge of sales, Buffalo Forge Co., Buffalo, N. Y., died on April 25 at the age of sixty-eight years. Mr. Cheyney had been active for years in the standardization of codes and procedures for fans and blowers. He is survived by his wife, three sons, and a brother.

DR. PAUL GRODZINSKI, a contributor to MACHINERY since 1934, died on February 20 in London, England. He is survived by his wife, son, and sister.

Coming Events

JUNE 11-14—Annual Cornell University Industrial Engineering Seminars sponsored by the Department of Industrial and Engineering Administration, Sibley School of Mechanical Engineering, Cornell University to be held at Ithaca, N. Y. There will be a series of seminar discussions led by specialists from both industry and the staff of Cornell University. Additional information can be obtained from Andrew Schultz, Jr., Department of Industrial and Engineering Administration, Cornell University, Ithaca, N. Y.

JULY 29-AUGUST 2—Annual Sales Conferences of Sales Executives, Advertising Managers, and Sales Engineers of member companies of the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION and the AMERICAN TOOL DISTRIBUTORS' ASSOCIATION to be held at Cornell University, Ithaca, N. Y. For further information contact Hill & Knowlton, 323 Republic Building, Cleveland 15, Ohio.

POPE engineers and builds 20,000 DIFFERENT MOTORIZED AND BELT DRIVEN SPINDLES

one of which may be just the one to LOWER YOUR PRODUCTION COST

Here are only a few representative Pope Precision Spindles:

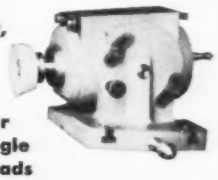
FOR SURFACE GRINDING

POPE 1, 2 and 3 HP Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with double row cylindrical roller bearings of enormous capacity for superior performance and long life, plus separate thrust bearings for no endwise movement of the shaft.

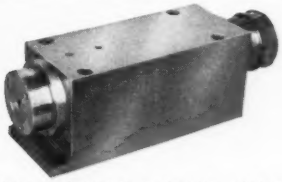
FOR HEAVY DUTY MILLING AND GRINDING

POPE ¾ to 100 HP Direct Motorized Spindles operate in any position — flanged or tapered noses — equipped with super-precision, double-row roller bearings and preloaded ball thrust bearings. Top quality performance is assured on skin milling, grinding, boring and other operations as well as milling.

FOR TOOL AND CUTTER GRINDING



POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.



FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles assure smooth, chatter free, continuous high production of accurate parts. Belt driven or motorized, in a wide range of horsepowers and speeds.

FOR INTERNAL GRINDING

POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Excello, Heald, Landis and Norton Grinders.

FOR HIGH CYCLE GRINDING AND MILLING

POPE Super-Precision, High Frequency, Heavy Duty Spindles are available for speeds up to 100,000 RPM. They are unequalled for low cost maintenance, long life, trouble-free operation and rugged ability to cut metal fast.

Send us your specifications and get prompt quotations on the one best Spindle for you out of the 20,000 different Precision Spindles that bear the name "POPE."

No. 120

POPE®

ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

New Books and Publications

MACHINE TOOLS—What They Are and How They Work. By Herbert D. Hall and Horace E. Linsley. 426 pages, 6 by 9 inches; 363 illustrations. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N.Y. Price, $5.50.

The book begins by defining the metalworking industry in terms of its products, things we all know and recognize. It then goes on to explain all of the important factors which make modern mass production possible; the skills in the machine shop; the kinds of machine tools that are used; the tooling-up of the machines; the gaging and inspection operations; the organization for production; and the ways in which time and motion study are employed to further efficient operation.

All phases of metalworking operations are covered including drilling, turning, planing, shaping, milling, grinding, pressworking, and operations that make use of transfer machines and other automation equipment. Special machining operations, such as gear cutting, gear shaping, and gear hobbing of spur and bevel gears; broaching; sawing; ultrasonic machining; and electrical discharge machining are also covered.

The use of turret and automatic lathes, their setup, manner of indexing, and operation are all discussed. Various other types of machine tools are described in considerable detail.

Originally appearing under the title "Machine Tool Primer," this book was published by the Herbert D. Hall Foundation as an introduction to the metalworking industry for students and men in industry who had little technical background. Now completely rewritten, enlarged, and with new illustrative material, it offers an attractive, easy-to-understand text for students in colleges, technical high and trade schools, and in specialized machine shop courses.

In their introduction, the authors state: "It is the hope of the Foundation that this improved work will serve to further its fundamental objective of stimulating the interest of young people in studying the metalworking trades, either to increase their general knowledge of this most vital of all industries, or to find therein an honorable and profitable livelihood."

When read carefully this book should provide the student with a good foundation for understanding how machine tools function in a modern manufacturing plant, whether he is going to be a machine operator, a toolmaker, an engineer, or a nontechnical employe in a metalworking plant. Although intended primarily for this purpose, Machine Tools—What They Are and How They Work is also an excellent book for the nontechnical employe in a metalworking plant and for the general reader who wants to know how mass production functions in this automated age.

The following chapter headings show the range of subject material covered: Things Machine Tools Make, Metalworking Processes in General, Mass Production Explained, Skills in the Machine Shop, Fits, Gaging and Inspection, Organizing for Production—Tooling Up, Efficiency—Time and Motion Study, Drills and Drilling Machines, the Metalworking Lathe, Turret Lathes and Automatic Lathes, Planing and Shaping, Milling and Milling Machines, Grinding and Grinding Machines, Other Machining Operations, Pressworking of Metals, and Transfer Machines and Automation.

MAINTENANCE ENGINEERING HANDBOOK. L. C. Morrow, Editor. Prepared by a staff of specialists. 1528 pages, 6 by 9 inches. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y. Price, $20.

This book shows plant engineers, maintenance executives, and company managers how to increase profits through better maintenance. More than seventy-five experts offer techniques, methods, and procedures to keep production at maximum levels, to control production costs and losses, and to prolong the productive life of plant and related equipment.

The information ranges from the organization and administration of maintenance forces to practical details of maintaining buildings and service equipment, sanitation and housekeeping, and corrosion control.

The book is planned to give a practical insight into management as well as operative phases of maintenance work—the principles of organization, training operators and supervisors, rating and evaluation of maintenance jobs, standard times for maintenance jobs, project control, and cost control.

The bulk of the book is made up of information relative to the selection, installation, and upkeep of the kinds of equipment and services that every plant must deal with; electrical, mechanical, and service equipment, transportation equipment, maintenance stores, instruments and instrumentation, and welding.

The maintenance of production equipment is treated to an extent that units entering into their design and construction are covered, such as bearing, clutches, chains, drives, gears, valves, and piping.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. Eleventh edition. 1300 pages, 6 by 9 inches; 1100 illustrations. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, $3.

This book is arranged and written as a reference book covering all phases of arc welding. Its contents range from the early history of arc welding to the intricacies of structural design. There are eight sections, divided by subject matter for easy study: history; nomenclature and process; weldability; mild steel procedures; manufacturing cost data; machine design; structural design; applications; and reference data. Each section has its own table of contents, and there is a complete alphabetical index for the entire book.

MOTION ECONOMY AND WORK MEASUREMENTS. By Robert Lee Morrow. 474 pages, 6 by 9 inches; 300 illustrations. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N.Y. Price, $7.50.

In this book the use of time study data is fully covered, and various motion time standards are compared and evaluated. Particular attention is given to work sampling techniques and their application to work simplification, setting of time standards, and control of manufacturing operations.

Also fully treated are such vital areas as fatigue measurement, standard data, micromotion studies, training of time study men, and automatic machine work assignments.

Application of motion economy techniques to both office and factory is fully explained. Points are illustrated and clarified by use of actual situations drawn from the author's experience.

(This section continued on page 258)

JONES & LAMSON
OPTICAL COMPARATORS

the man who needs
a new machine tool is
already paying for it

Rapid Inspection Between Operations Keeps Quality High, Scrap Low

Things start to happen when J & L Optical Comparators are put to work on production line inspection. Parts — even the most intricate ones — are inspected more easily and more rapidly than ever before. Measurement is precise to .0001". Parts which undergo several operations are speedily checked *at each stage* of manufacture. Any errors present in production operations are instantly revealed.

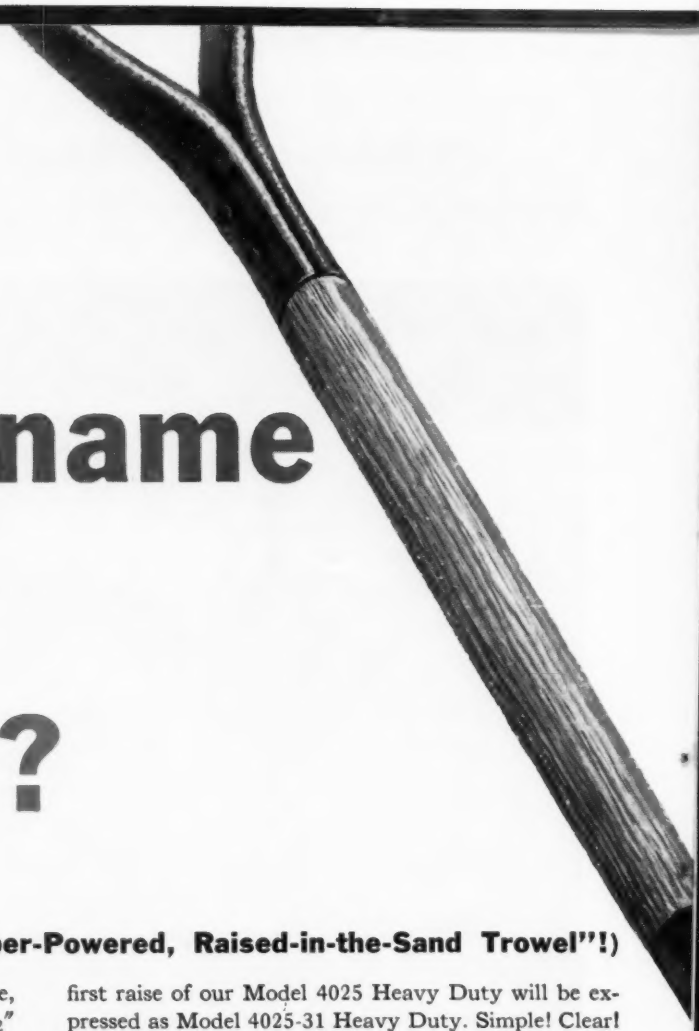
As a result of all this, production flow is faster and surer, product quality is kept on a higher level, and *scrap* volume takes a nose dive.

Investigate the possibilities that lie in using J & L Optical Comparators in *your* manufacturing. Send for our latest Comparator Catalog. JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 229

Know a better name than "Spade"?



(It certainly isn't "Heavy-Duty, Super-Powered, Raised-in-the-Sand Trowel"!)

Same goes for lathes! Why call a lathe a 16″ machine, when it may swing 18½″ over the bed and only 12½″ over the cross slide—more or less? Especially when most lathe types are used largely for between center work? Monarch is proud to be a part of the Lathe Group that has performed a real service to lathe buyers by proposing the commonsense, informative four-digit designation system. And *we're* going even further. Henceforth every Monarch model designation on new lathes will give you a complete description at a glance!

The Four-Digit System

This is simplicity itself. The first two digits reveal swing or clearance over bed and carriage wings. Second two digits, swing over cross slide on the basic machine. A reference to the chart shows how immediately informative this is.

Raising—and Heavy Duty Information

Now, you know where you stand with Monarch—as in contrast with such practices as calling a basic 20″ machine a 20″ heavy duty, then raising it to 25″ and calling the raised model a 25″ standard.

All Monarch lathes designated "Heavy Duty" are engineered heavy duty machines—and the specifications reveal the weight, power, and capacity to justify the term. Where engineered raises in the sand are involved, the basic designation will be used, followed by a dash and the raised clearance. For example, the first raise of our Model 4025 Heavy Duty will be expressed as Model 4025-31 Heavy Duty. Simple! Clear! Understandable! Factual!

The "Engine" vs "Toolmaker's" Doubletalk

The fact that these terms still exist at all is a tribute to the force of habit. For years, we've only made one grade of lathe—the best within our power. Every machine has the utmost in built-in precision and production because the close manufacturing limits of today are equal to and often surpass the toolroom limits of yesterday, while high labor rates make it essential that toolroom operations be placed on the highest possible productive basis. It is true that a lathe for toolroom use must, as a rule, have more flexibility than one for manufacturing purposes. So, on many models, we furnish a standard complement of additional equipment. Machines with such equipment differences are designated with the suffix "T". Model 1610 becomes Model 1610-T. As for the word "Engine" applied to a lathe, it lost meaning years ago. Let's bury it!

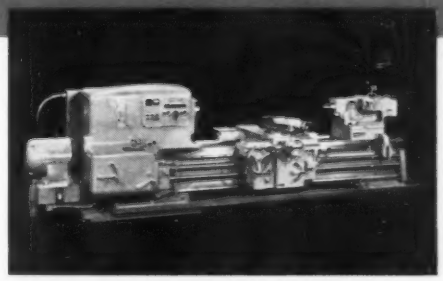
In a Nutshell...

Now you know how to appraise the swing capacity of every Monarch Lathe at a glance. We hope the day will come soon when the same nomenclature will apply to all lathes made. Then nobody will have to dig for the facts—The Monarch Machine Tool Company, Sidney, Ohio.

SIZE DESIGNATIONS

Machine	New Four-Digit System	Outmoded Size Designations
Series 62 Preselector Dyna-Shift	1610	13″ Engine
	1610-13	13″ Raised Engine
	2013	16″ Engine
	2013-16	16″ Raised Engine
	2516	20″ Engine
	2516-19	20″ Raised Engine
Series 80 Heavy Duty Dyna-Shift	2516	20″ Heavy Duty Engine
	2516-20	20″ Heavy Duty Raised Engine
	3220	25″ Heavy Duty Engine
	3220-24	25″ Heavy Duty Raised Engine
	3220-28	25″ Heavy Duty Raised Engine
Series 90 Heavy Duty Dyna-Shift	4025	32″ Heavy Duty Engine
	4025-31	32″ Heavy Duty Raised Engine
	4025-36	32″ Heavy Duty Raised Engine

NOTE—Older models, namely Model EE Manufacturing and Toolmaker's, Series EE-Model 1000, Series 61 Engine and Toolmaker's Lathes and Models M, N, and NN Heavy Duty Engine Lathes will retain old designations because of long-established user acceptance. The suffix "T" after the following model designations denotes inclusion of additional equipment usually required for toolroom use—1610, 1610-13, 2013, 2013-16, 2516, 2516-19.



For Example:

Monarch Series 90 Heavy Duty Dyna-Shift—Model 4025-31
Basic Clearance over Bed and Carriage Wings—40″
Basic Swing over Cross Slide—25″
Raised Swing over Cross Slide—31″

Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

PRESS DIE DESIGN AND CONSTRUCTION. PARTS 1 AND 2. Yellow Back Series Nos. 24 and 24A. 50 pages in each part, 5 1/2 by 8 1/2 inches; 42 illustrations in Part 1, 47 illustrations in Part 2. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents each.

For those interested or engaged in the design and construction of dies used on presses for the manufacture of sheet-metal components, these books provide a means of becoming acquainted with the fundamental principles of press die design and their application in the construction of various dies. Part I gives the basic principles of design and construction and also gives a description of return type blanking dies, knockout mechanisms and compound blanking and piercing dies. Part II continues the description and constructional details of other types of dies; these include progressive blanking and piercing dies, shear type piercing and cutting-off tools, slug type cutting-off dies and piercing, cutting-off and forming dies.

TRANSISTOR ENGINEERING REFERENCE HANDBOOK. By H. E. Marrows. 288 pages, 9 by 12 inches. Published by John F. Rider, 116 W. 14th St., New York 11, N. Y. Price, $9.95.

A complete handbook for use in engineering, scientific research, and manufacturing of transistor devices. This profusely illustrated book contains five individually indexed sections. Section 1 deals with transistor materials, the structure and fabrication of all types of transistors, and characteristics of various type junction transistors. Also, a special bibliography on transistors is presented. Section 2 gives a numerical index of all transistor types, specification sheets, operating parameters, and characteristic and performance curves.

An index of related components is presented in the third section, and Section 4 is devoted to commercial applications of transistors, with schematic diagrams. Section 5 contains a directory of manufacturers making transistors and components designed for use with transistors.

* * *

Microfilms of MACHINERY Available for Libraries and Companies

All pages of MACHINERY for full years are available on microfilm at nominal cost. They can be obtained from University Microfilms, 313 N. First St., Ann Arbor, Mich.

Review of Available Motion Pictures

GRINDING WHEELS

"How to Select the Right Grinding Wheel" is the title of a 16-millimeter, sound and color motion picture released by the Norton Co. This thirty-minute film explains the typical grinding wheel markings and shows the variations of each unit symbol. A step-by-step development of recommended grinding wheel specifications for two specific grinding jobs is included. For bookings, write to Norton Co., Worcester 6, Mass. A special condensation of the film story is also available for distribution to audiences.

TURRET DRILLS

A 16-millimeter, black and white, sound motion picture describes the manufacture and operation of Burgmaster turret drills. The twenty-five-minute film has been produced by the Burg Tool Mfg. Co., Inc. Also included is the operation sequence of the company's electronically controlled positioning table—from the marking of the tape to the resultant automatic operation of the spindles. Requests for this film should be addressed to the company at 15001 S. Figueroa St., Gardena, Calif.

HYDRAULIC DUPLICATING ATTACHMENT

A thirty-six minute 16-millimeter, sound and color film entitled "The Rockford Kopy-Kat" shows the design and operation of the Rockford hydraulic Kopy-Kat duplicator, an auxiliary tracing attachment for Rockford lathes, hydraulic shapers, planers, slotters, and shaper-planers. The film also includes both animated schematic diagrams illustrating the operation of the valve and hydraulic system, and a variety of actual duplicating jobs. Reservations can be made by calling the local factory representative or writing to the Rockford Machine Tool Co., Department T, 2500 Kishwaukee St., Rockford, Ill.

MACHINE BENDING TECHNIQUES

Cold machine bending is the subject of a 16-millimeter, color and sound film that has been made available by the Pines Engineering Co., Inc. The motion picture shows both standard and special tooling applications under actual job conditions. Intended for engineering and production executives, the forty-minute film illustrates such operations as the bending of tubes, pipes, steel channels, and aluminum extrusions. Interested manufacturing organizations can obtain this film without charge by writing to the Pines Engineering Co., Inc., Aurora, Ill.

HOW WELDING ENGINEER SERVES INDUSTRY

"Modern Methods for Joining Metals," a twenty-minute, sound-color motion picture that illustrates the importance of the welding engineer in industry has been released by the Linde Air Products Company. This film shows a variety of welding processes and applications, and points out the role of research development and engineering in providing better methods and equipment. Subject matter is presented in a nontechnical manner. The film may be obtained by writing to the Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y.

ABRASIVE-BELT GRINDING MACHINES WITH MULTIPLE HEADS

"Two Heads Are Better Than One" is the title of an eighteen-minute, sound-color motion picture produced by the Engelberg Huller Co. The 16-millimeter film shows multiple-head models of abrasive-belt grinding machines being used in various industrial applications. These conveyor type machines are shown performing several different multiple grinding operations on a number of materials. An automatic abrasive-belt grinding machine of the rotary type for high-speed precision applications is also featured. Requests for this film should be made on company letterhead and sent to John Simons, product manager, Engelberg Huller Co., Inc., 831 W. Fayette St., Syracuse 4, N. Y.

High-Precision Gear Production

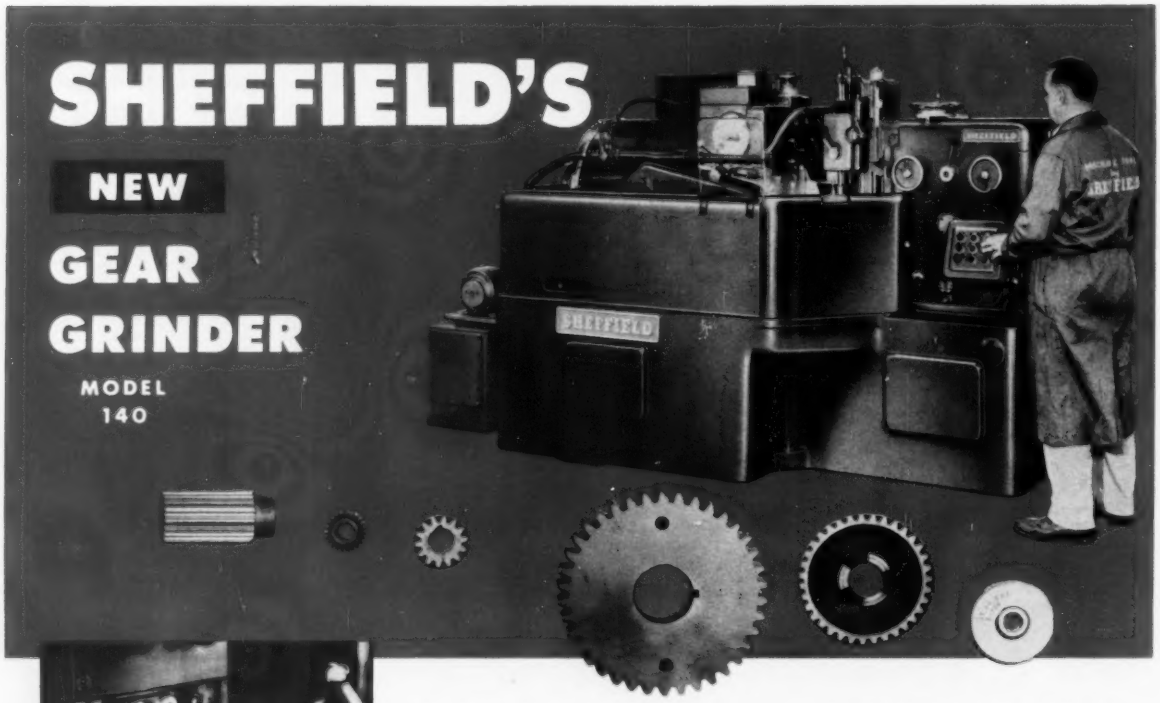
INCREASED 300% *on*

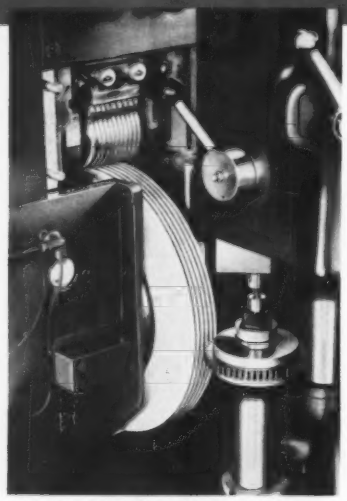
SHEFFIELD'S

NEW

GEAR GRINDER

MODEL 140





Relationship of crushing roll, grinding wheel and work part.

Precision gears for aircraft, fire control, servo mechanisms, guided missiles, transmissions and machine tools may be ground to a total composite error of less .0005" at production rates three times faster than heretofore possible.

The secret is a fast-cutting grinding wheel accurately crushtrued to the basic rack form, operated like a hob and with the work rotating as the teeth are ground—either from the solid hardened blank or a preformed gear.

FIELD REPORTS—An aircraft engine manufacturer says "Gears ground on the Model 140 Grinder have passed our surface tempering inspection and show no grinding burns".

A large precision instrument manufacturer, in speaking of the Model 140, writes, "We have inspected gears ground on prominent gear grinders of both American and European manufacture. Our findings have revealed that this machine is by far the most accurate to date."

MACHINE CAPACITY (Work Gear)

Outside Diameter	Up to 8"	Pitch	8 to 100
Face Width	Up to 5"	Helix Angle	Up to 45°
Distance between centers	15"		

For complete information, write to The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. M

the **SHEFFIELD** *corporation*

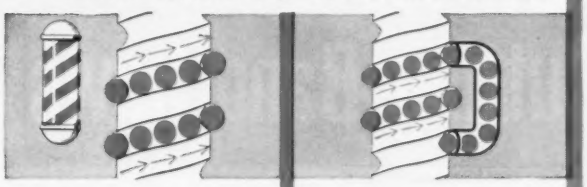
...measurement for mankind

ACTUATION PROBLEM too tough for ordinary devices?

SAGINAW CAN HELP YOU SOLVE IT!

Saginaw b/b Screws guaranteed 90% efficient —offer 6 major advantages for designers

Available in custom machined and commercial rolled thread types—have been built from 1½ inches to 39½ feet long—⅜ to 10 inches diameter.



Nut *glides* on steel balls. Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.

At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

1 VITAL POWER SAVINGS. With guaranteed efficiency of 90%, Saginaw b/b Screws are up to 5 times as efficient as Acme screws, require only ⅕ as much torque. This permits much smaller motors with far less drain on the electrical system. Circuitry is greatly simplified.

2 SPACE/WEIGHT REDUCTION. Saginaw b/b Screws permit use of smaller motors and gear boxes; eliminate pumps, accumulators and piping required by hydraulics. In addition, Saginaw b/b Screws themselves are smaller and lighter. Units have been engineered from 1½ in. to 39½ ft. in length.

3 PRECISE POSITIONING. Machine-ground Saginaw b/b Screws offer a great advantage over hydraulics or pneumatics because a component can be positioned at a predetermined point with precision. Tolerances on position are held within .0006 in./ft. of travel.

4 TEMPERATURE TOLERANCE. Normal operating range is from −75° to +275° F., but assemblies have been designed in selected materials which function efficiently as high as +900° F. These units are practical where hydraulic fluids have lost efficiency or reached their flash point.

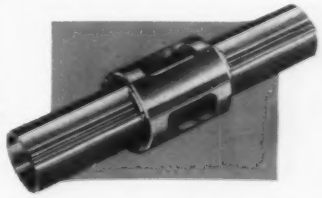
5 LUBRICATION LATITUDE. Even if lubrication fails or cannot originally be provided because of extreme temperatures or other problems, Saginaw b/b Screws will still operate with remarkable efficiency. Saginaw units have been designed, built and qualified for operation without any lubrication.

6 FAIL-SAFE PERFORMANCE. Far less vulnerable than hydraulics. In addition, Saginaw offers three significant advantages over other makes: (1) Gothic arch grooves eliminate dirt sensitivity, increase ball life; (2) yoke deflectors and (3) multiple circuits provide added assurance against operating failure.

YOUR FREE COPY OF THIS NEW b/b SCREW AND SPLINE "PROBLEM SOLVER" SHOWS HOW

36 pages crammed with time-, work-, and money-saving facts: Principles • Types • Basic Operations • Coupling Methods • Efficiency • Advantages • Selection Factors • Design Data • Sample Problems

SAGINAW b/b SPLINE



● Averages 40 times lower coefficient of friction than ordinary sliding splines!

Utilizing the same basic *gliding ball* principle, Saginaw has developed the *Saginaw b/b Spline* which radically increases the efficiency of transmitting or restraining high torque loads.

It can be fitted with integral gears, clutch dogs, bearing and sprocket seats, etc. Units have been built from 3 inches to 10 feet long—⅜ to 6 inches in diameter.

SEND TODAY FOR THIS FREE 1957 ENGINEERING DATA BOOK . . .

or see our section in Sweet's Product Design File

Saginaw ball bearing Screws and Splines

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS

WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
Dept. 7Y, Saginaw, Michigan

Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Great in its day...

BUT WOULDN'T YOU
RATHER HAVE
THE LATEST
TECHNICAL ADVANCE?

Now! An important new improvement in metal cutting

Heller *"Job Tempered"* Metal Cutting Band Saws

Certified by American Standards Testing Bureau* to meet their standards for Superior Cutting — Uniform Teeth... Uniform Set... Uniform Temper

When band saw machines are equipped with the *right* blade from Heller's brand new line of metal cutting band saws they give exceptionally fast clean cuts — at minimum unit cost — on a wide variety of materials and for long service periods.

Users report these better results because *every* Heller blade is JOB TEMPERED. Steel of a special controlled-analysis specified by Heller metallurgists, is heat treated by a unique process *matched to the steel.* This insures uniform temper and cutting qualities that mean unsurpassed performance on the job.

Teeth are made uniform in size, shape and spacing by machines of specialized design — the most modern in the industry.

Uniform set is made absolutely *certain* by a highly sensitive indicator developed for just this purpose.

Because of these improvements in the art of band saw manufacture, American Standards Testing Bureau gives its assurance that Heller's great new line of saws meet their standards for superior cutting: uniform teeth — uniform set — uniform temper.

Why not put these exceptional blades to work earning for you?

* AMERICAN STANDARDS TESTING BUREAU INC. ASTB

HELLER TOOL CO. SINCE 1836

Heller

HELLER TOOL CO., *America's Oldest File Manufacturer*
Newcomerstown, Ohio — A Subsidiary of Simonds Saw and Steel Co.

YOU GET THESE HELPFUL EXTRAS WHEN YOU USE HELLER BLADES

SOLD EXCLUSIVELY THROUGH

Heller DISTRIBUTORS
"YOUR OUTSIDE TOOL ROOM"
Heller "Job Tempered" Tools

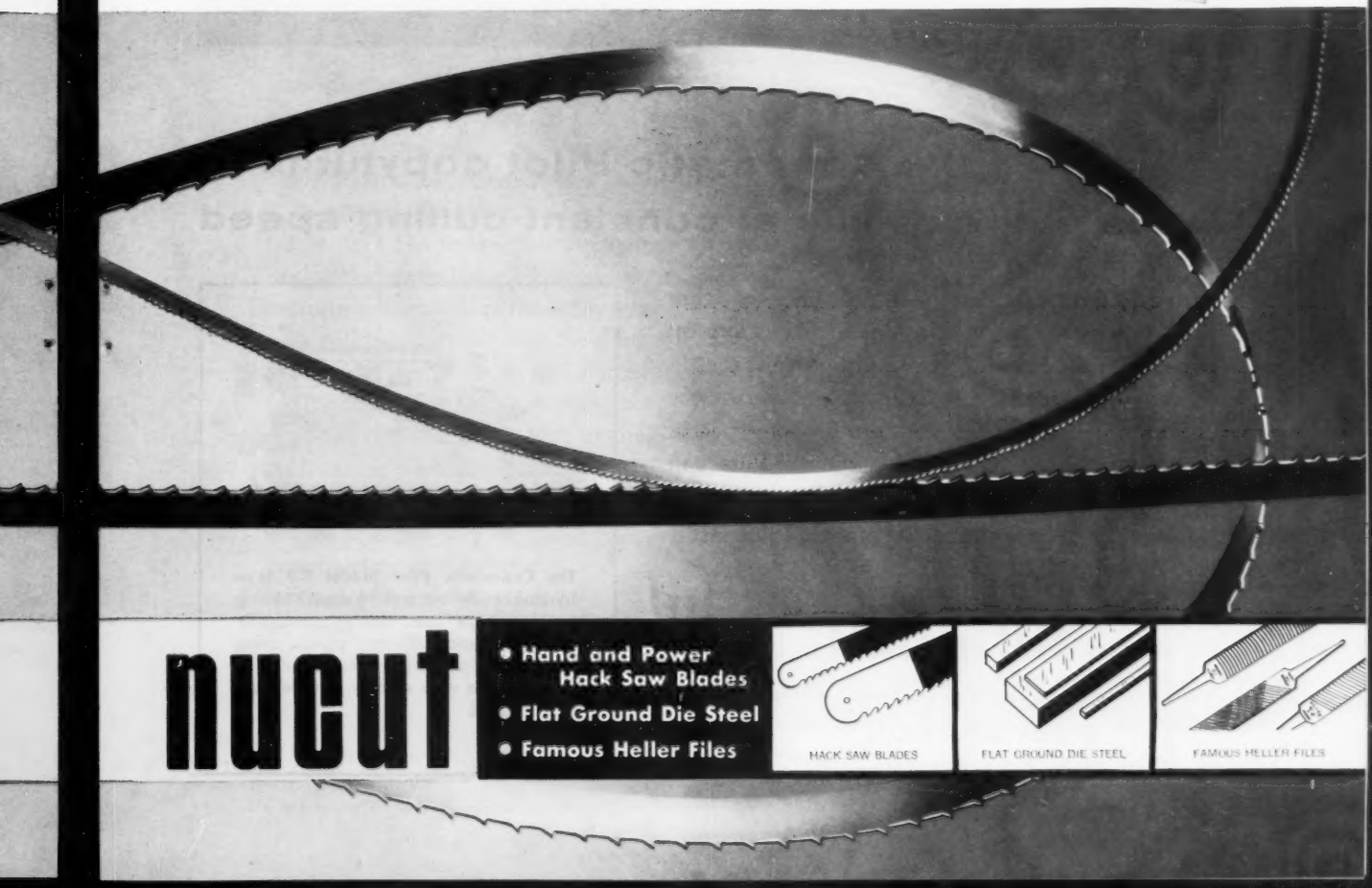
1. COMPLETE SELECTION Heller offers a full selection of "Job Tempered" Metal Cutting Band Saws. You can choose exactly the right tooth shape, set, and blade width in standard or high speed steel as required for your application.

2. CHARTS AND BOOKLETS FOR USERS Your Heller Distributor will furnish you with wall charts and booklets to help you choose the *right* Metal Cutting Band Saw for your applications. These visual aids will show you the speeds and feeds required for best cutting results, for contour cutting or cutoff work.

3. CONVENIENT PACKAGING Heller's packaging is designed for maximum user convenience. Blades come in bulk lengths of 100′ and 250′ coils so you can cut and weld the length you need when you need it. Or individually packaged blades are furnished cut and welded to fit all standard machines.

HERE ARE THE FACTS! Heller's new catalog of "Job Tempered" Metal Cutting Band Saws contains descriptions of all types of blades, tooth shapes, set, applications.

WRITE FOR YOUR COPY TODAY!



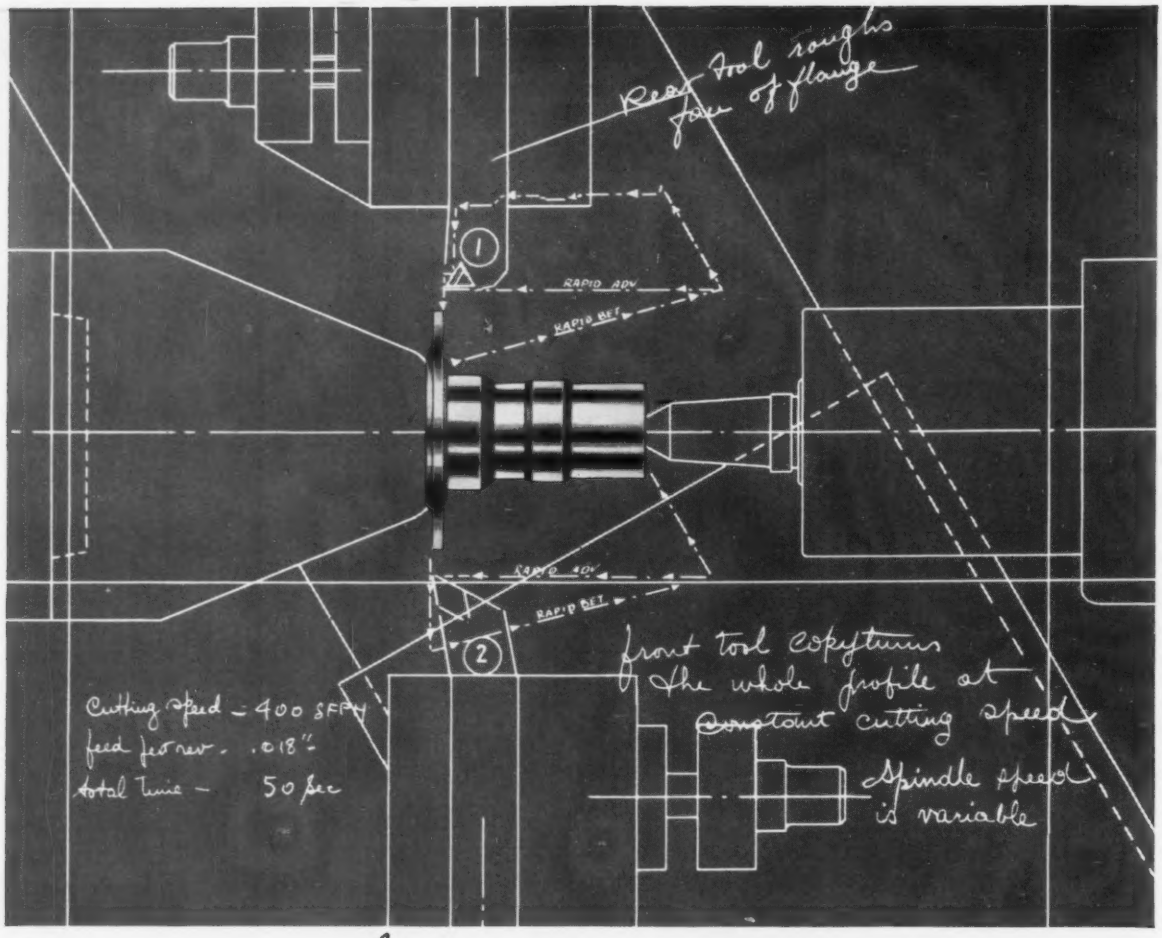
nucut

- Hand and Power Hack Saw Blades
- Flat Ground Die Steel
- Famous Heller Files

HACK SAW BLADES

FLAT GROUND DIE STEEL

FAMOUS HELLER FILES

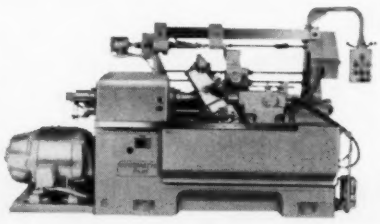

Rear tool roughs face of flange
RAPID ADV
RAPID RET
RAPID ADV
RAPID RET
Front tool copyturns the whole profile at constant cutting speed
Spindle speed is variable
Cutting Speed - 400 SFPM
feed per rev. .018"
total Time - 50 sec

In 50 seconds

the Conomatic Pilot copyturns this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

Write today for details of the Conomatic Pilot lathe.



The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

Conomatic

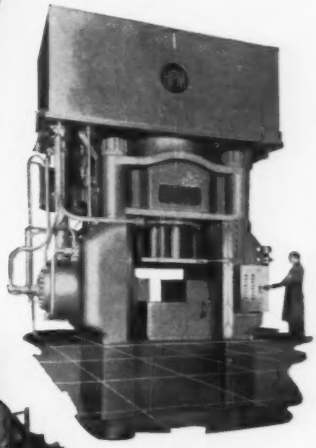
CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

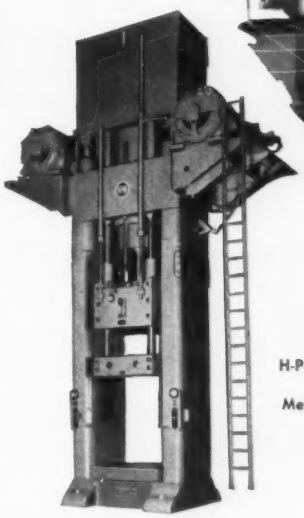
30 Rockefeller Plaza, New York 20, N. Y.

HPM

80 YEARS BUILDING A TRADITION



H-P-M Metalworking Titanium Briquetting Press



H-P-M All-Hydraulic, Fastraverse Metalworking Press

Unlike many anniversaries that are built to exaggerated proportions, H-P-M is entering its eighty-first year with a minimum of interest in the past. Instead our research and development have geared our efforts to a program for the future. We like to feel that throughout our long and varied experience we have learned to anticipate the needs of the many industries with which we work. It is their future that guides our planning and our policies for the days ahead. This thinking has traditionally guided H-P-M to its present position as a leader in the hydraulic industry. Our goals will be changed only to provide more and better service to the industries we serve.

HPM

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

A DIVISION OF KOEHRING COMPANY

1877—1957

For more information fill in page number on Inquiry Card, on page 229

1951 PARIS
1952 HANNOVER
1953 BRUXELLES
1954 MILANO
E
5th EUROPEAN
Machine Tool Exhibition
HANOVER 1957
September 15th to 24th
Information:
General-Kommissariat der 5. Europäischen Werkzeugmaschinen-Ausstellung
Hannover-Messegelände Tel.: 86501 Telegr. address: Modul Telex: 092 2728

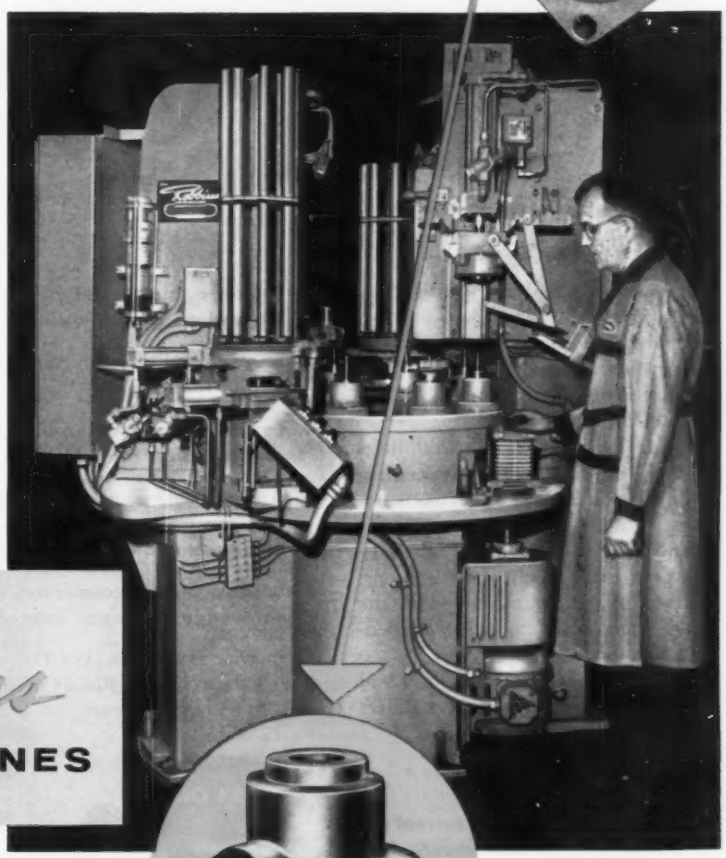
720 Assemblies Per Hour AUTOMATICALLY!

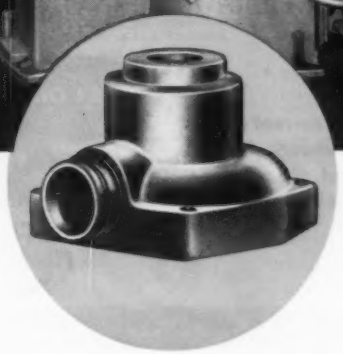
This Robbins "Assemblimatic" feeds, positions, assembles and unloads automatically . . . producing 720 four-piece assemblies every hour! It assembles a needle bearing, washer and seal in two sizes of a steering gear end cover. Parts are fed and positioned from indexing magazines, and completed assemblies are removed and placed on a conveyor . . . all automatically.

Machine features include: (1) Robbins panel, one-third standard size, with plug-in aircraft type relays and controls which prevent assembly unless parts are correctly positioned, (2) Index table with both barrel type cam and shot bolt for accuracy and magnetic operation of index and dwell, (3) Positive dwell time control through synchronous timer and electrical interlock at each station, (4) Hardened and ground ways, (5) Automatic lubrication, (6) Electrical and pneumatic equipment to J.I.C.

Robbins special assembly machines save manpower, speed production and improve quality, often combine machining with assembly for further savings. Automatic inspection, selection, orientation, assembly and in-process gaging assure consistent high quality production. Ask us for recommendations to help solve your automatic assembly or machining problem.

OMER E. ROBBINS COMPANY
24802 PLYMOUTH ROAD • DETROIT 39, MICH.

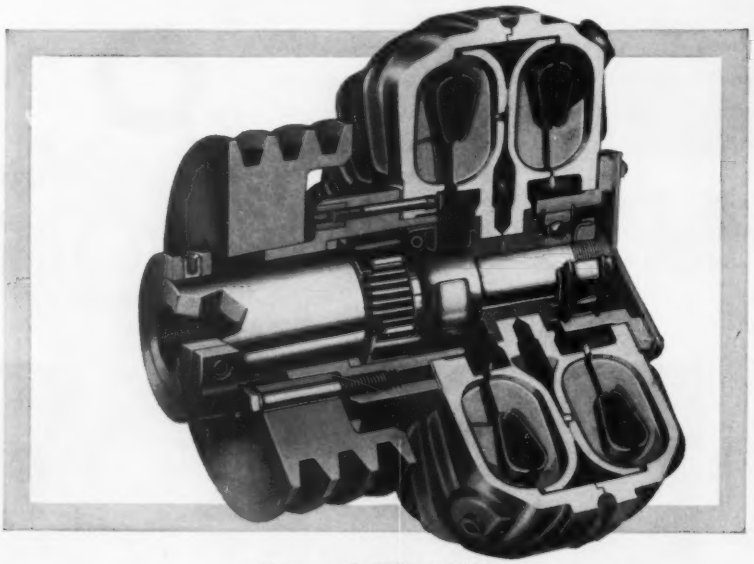




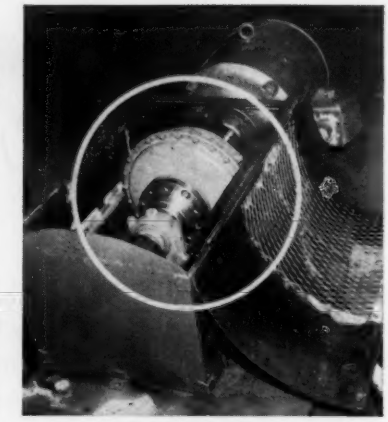
Robbins
SPECIAL MACHINES

New brochure describes and illustrates a variety of Robbins special assembly machines. Write for your copy.

Here's why machinery lasts longer *WHEN POWERED THROUGH FLUID*



Cut-away of HYDRO-SHEAVE



case history

Location: Milwaukee, Wisconsin, plant of Doelger & Kirsten, Inc.

Equipment: A 30-year-old boring mill.

Problem: Originally this machine was equipped with a variable speed drive. This drive arrangement, however, was not satisfactory because backlash prevented making maximum cuts at maximum feed and impaired the quality of finished work. Later the original drive arrangement was replaced with an electric clutch, but operating improvement was not gained to any great extent.

Solution: A Twin Disc 14.5 Fluid Coupling was installed between the boring mill's 25-hp electric motor and the machine's drive train.

Observed Results: According to William Reichert, Plant Foreman, "We can now take extremely heavy cuts and maximum feed and, because backlash is eliminated, an excellent finish is assured." In summarizing the advantages gained by the installation of the Twin Disc Fluid Coupling, Mr. Reichert indicated:

1. Inching facilities are now extremely good.
2. Gear-teeth chatter has been eliminated.
3. Forward and reverse of motor is no longer a problem.
4. Backlash is completely eliminated.
5. The conversion was economical.

This is another factual report on how industry profits through the use of Twin Disc Fluid Drives. For complete information, write Twin Disc Clutch Company, Racine, Wisconsin.

Wherever you find shock loads, torsional stresses or vibrations, you can bet both driving and driven equipment will show undue wear.

That is, *unless the power is transmitted through fluid!*

With Twin Disc Fluid Couplings and HYDRO-SHEAVE® Drives, there are no mechanical connections between driving and driven equipment . . . no metal-to-metal contact to transmit destructive shocks and vibrations. These, instead, are absorbed in the fluid—not in your machinery's expensive components.

But that's not all. Twin Disc Fluid Couplings and HYDRO-SHEAVE Drives offer such advantages as—

1. **Reduce motor starting current demands . . . provide smooth, fast acceleration . . . and often improve over-all power factor.**
2. **Protect against overloads, stalling and motor burn-outs.**
3. **Transmit full input torque at all output speeds.**
4. **Permit motor selection based on running rather than starting load.**
5. **Are engineered as a "package" . . . can be installed in minutes on any standard keyed shaft.**
6. **Because of fluid connection, *cannot* wedge or "freeze" internally.**

Twin Disc HYDRO-SHEAVE Drives—¾ to 50 horsepower; Fluid Couplings—¾ to 850 horsepower.

TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

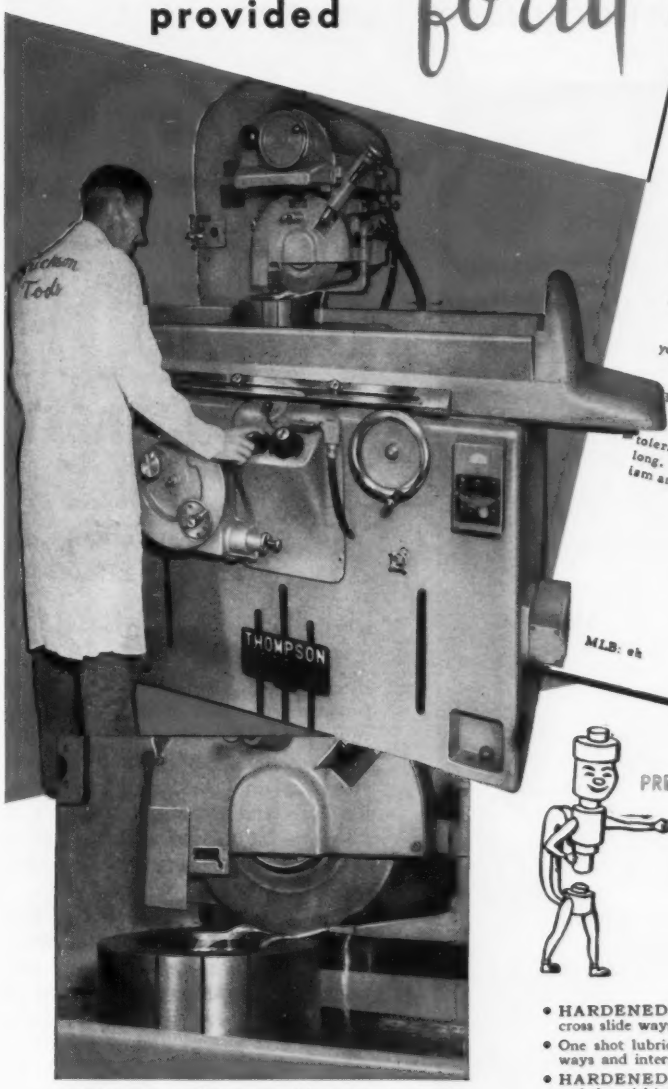
TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

Branches or Sales Engineering Offices: Cleveland • Dallas • Detroit • Los Angeles • Newark • New Orleans • Tulsa

The Erickson Tool Company
asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 83rd AND HAMILTON AVENUE
CLEVELAND 14, OHIO

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB: eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel TRUING device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY · SPRINGFIELD, OHIO

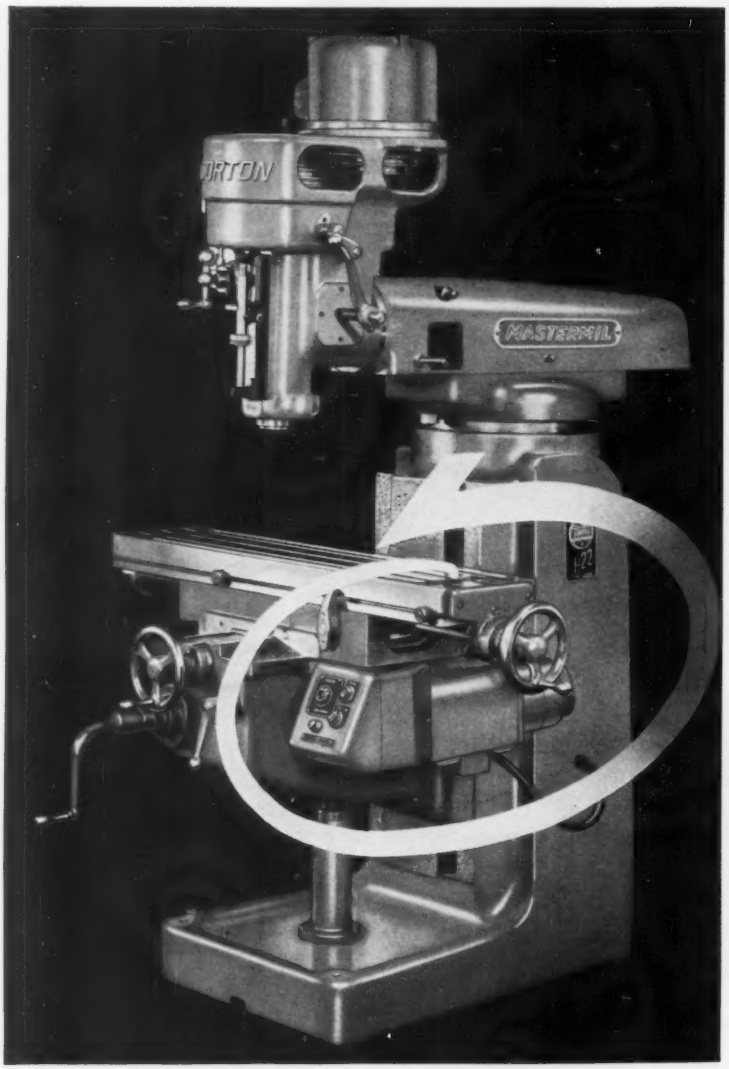
For more information fill in page number on Inquiry Card, on page 229

For the first time—on any milling machine

ELECTRONIC DYNA-DRIVE

REGISTERED TRADE MARK

THE "TORQUE-THINKING" TABLE FEED



Yours *EXCLUSIVELY* with

GORTON MASTERMIL

It "feels"... as it feeds

● The exclusive Gorton Dyna-Drive® Table Feed unit "thinks while it works." It automatically adjusts to provide the exact amount of torque required. This electronic "brain" compensates during the cutting operation for small variation in density, hardness and molecular structure of the material being machined. Results are exceptionally fine finish and prolonged cutter life.

The Gorton Mastermil is precision-built throughout, simple, rugged with the finest milling head of any machine in its class. Ram adjusts in and out. Turret revolves and spindle swivels 90° left or right.

Learn more about th's remarkable machine by writing for bulletin 2699-A—1306

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

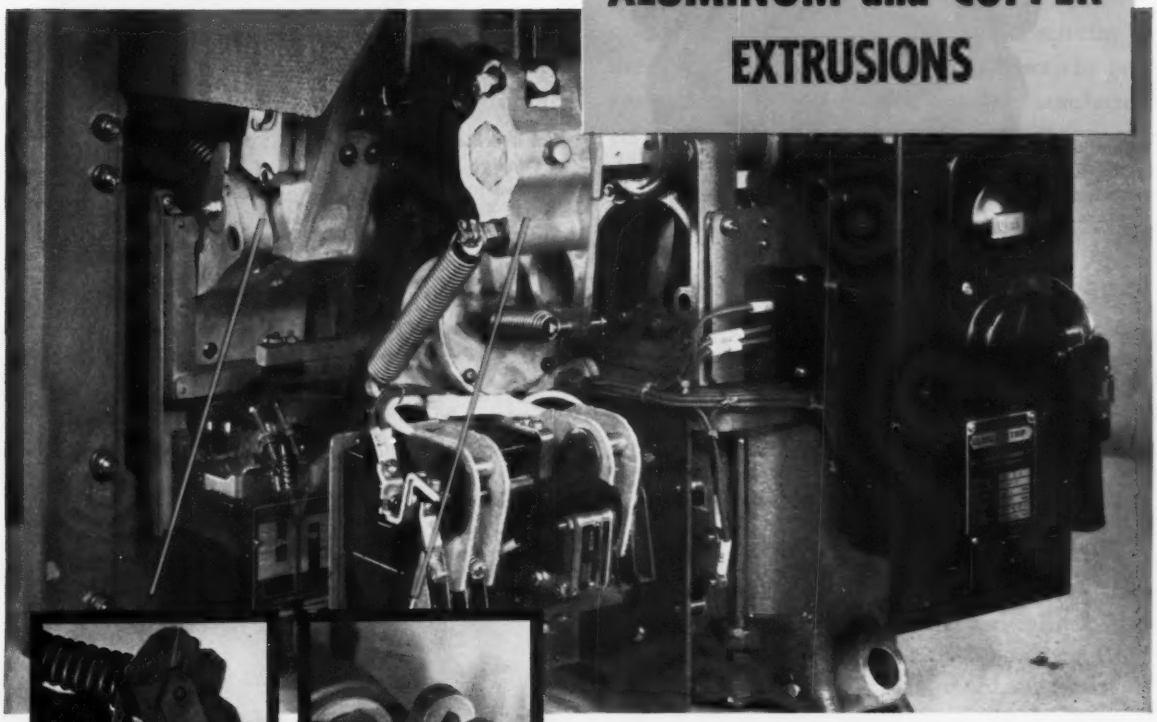
1306 Racine Street • Racine, Wisconsin 56-1

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

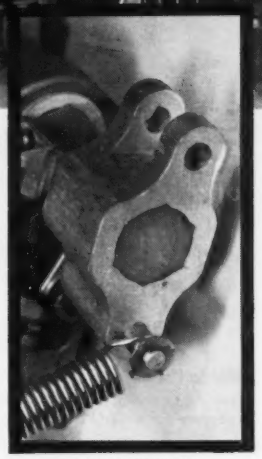
A7-1003-1P

REVERE
ALUMINUM and COPPER EXTRUSIONS

I-T-E CIRCUIT BREAKER—KD (3,000 amp. rating) showing progressive assembly with Revere Copper and Aluminum Extrusions in place. I-T-E Circuit Breaker—KE is same type with 4,000 amp. rating.



COPPER
for conductivity



ALUMINUM
for economy

—form a Money-Saving team in latest

I-T-E CIRCUIT BREAKERS

Revere T. A. Service an Important Factor in Ultimate Design of Parts

The larger of the two extruded and drawn copper shapes shown at extreme left started out on the drawing board as two pieces. It was thought that a single shape of this size could not be made satisfactorily. At this point, I-T-E Engineers got together with Revere's T. A. (Technical Advisory) Service and threshed things over. The final result is the one-piece extrusion shown and a reduction in machining time.

Aluminum was selected for the other extrusion shown because I-T-E found that it cost less per pound of metal and had a higher strength ratio when compared to a casting. Also, space was a factor. In all, Revere supplies 5 copper and 2 aluminum extrusions for KD and KE type I-T-E Circuit Breakers. All were designed to fit specific requirements of I-T-E Engineers. Where it could be used satisfactorily, aluminum was applied because of economy, while current carrying members called for copper.

This is still another example of Revere supplying the metal that will do the best job and with the greatest economy . . . be it aluminum, copper or any one of their alloys. So, with new things happening all the time in non-ferrous metals it can pay you to keep in close touch with Revere.

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMINUM

REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

For more information fill in page number on Inquiry Card, on page 229

Original design *requires ½" sections, weighs 896 pounds.*

Present welded steel design *uses ¼" sections, weighs only 446 pounds.*

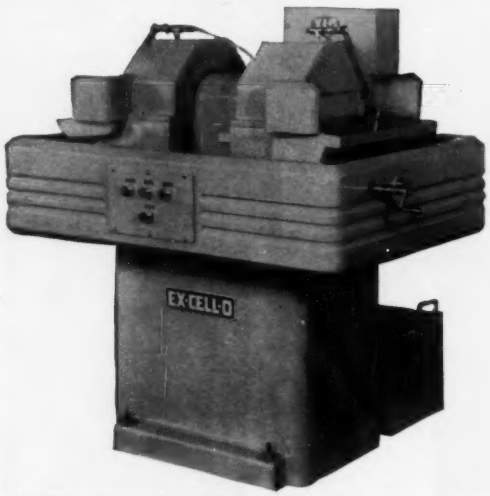
DESIGNED FOR GREATER RIGIDITY

. . . welded steel makes it better—at lower cost

THIS machine tool base was once a casting, but is now fabricated by welding. The result . . . still higher quality, more rigid machine.

Because of steel's greater strength, the required rigidity is attained with half the weight of casting. Manufacture is simplified, pattern expense is eliminated, lowering production costs.

These benefits can be duplicated on many types of machine components similar to your own through proper design for welded steel. A Lincoln specialist will gladly show you how.



Welded steel *tool grinder for sharpening single point tools of carbide, cast alloys and high speed steels. Photo courtesy Ex-Cell-O Corporation, Detroit, Michigan.*

THE LINCOLN ELECTRIC COMPANY

Dept. 1221, Cleveland 17, Ohio

Creating lower costs for industry . . . with welded design

When steel is 3 times stronger than iron . . .

Has two and one-half times the rigidity . . .

Yet costs a third as much per pound . . .

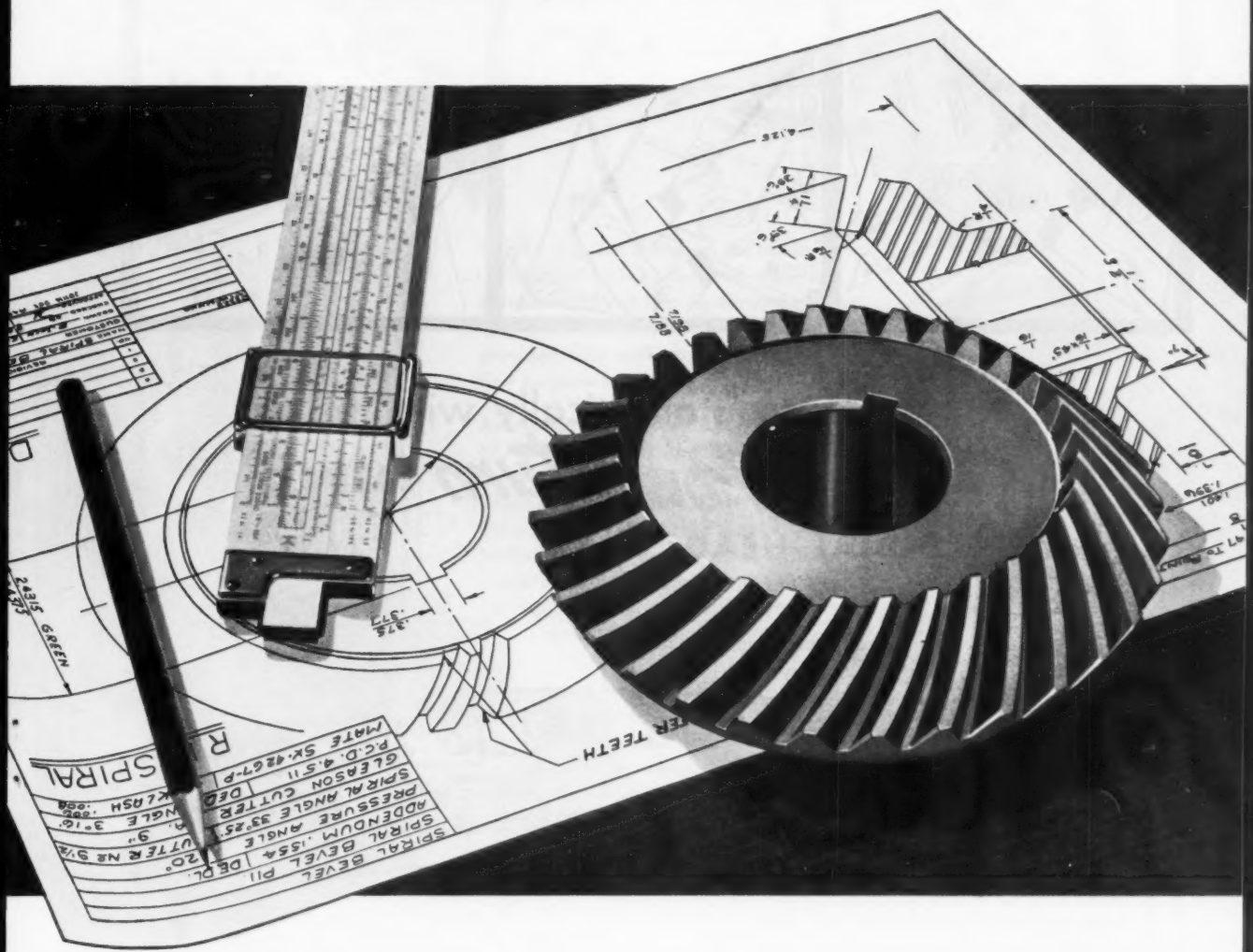
WHY

aren't your products designed for welded steel.

For more information fill in page number on Inquiry Card, on page 229

"ENGINEERED QUOTATIONS"

When our engineers study our customers' prints, they look for ways to improve gear performance, ways to simplify gear installations, ways to cut gear costs. When they find a way that they consider better they report it to the customer for his consideration. Very often these "engineered quotations" are accepted. Such careful scrutiny of every engineering and manufacturing step by *gear specialists* is one reason why so many manufacturers use Automotive Gear Division as their "gear department". May we submit an "engineered quotation" on your gear requirements?

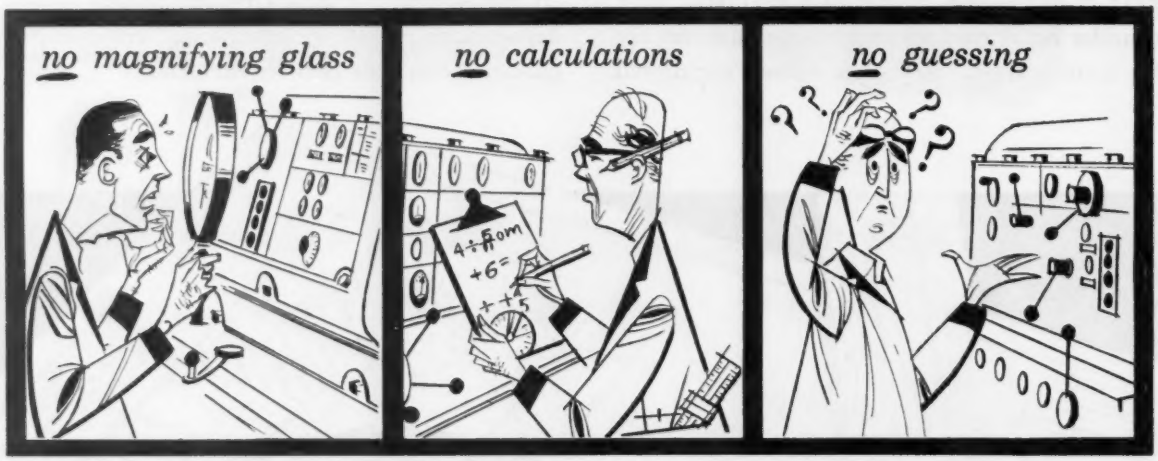


EATON

AUTOMOTIVE GEAR DIVISION
MANUFACTURING COMPANY
RICHMOND, INDIANA

GEARS FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Know your feed... set your speed!

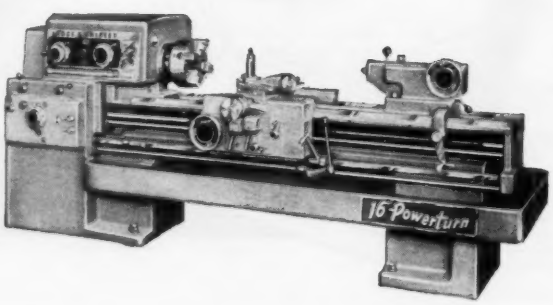


quickly . . . almost automatically with the LODGE & SHIPLEY *Powerturn* LATHE and SPEED-DIAL HEAD!

Take "by-guess" and "by-golly" confusion out of lathe operation! Lodge & Shipley POWERTURN Lathes with *Speed-Dial* Head make speed selection and setting simple as **a...b...c!**

a . . . set work diameter
b . . . read r.p.m. opposite cutting speed
c . . . set levers to automatic indicator lights

This time-saving, fool-proof simplicity is but one feature of New POWERTURN Lathes. Combined with traditional Lodge & Shipley accuracy and rugged strength are many other features for new precision and new operating convenience. New literature . . . ready now . . . tells the complete story: how POWERTURN Lathes are designed to facilitate turning to higher levels of profitable operation. 13, 16 and 20-inch sizes.



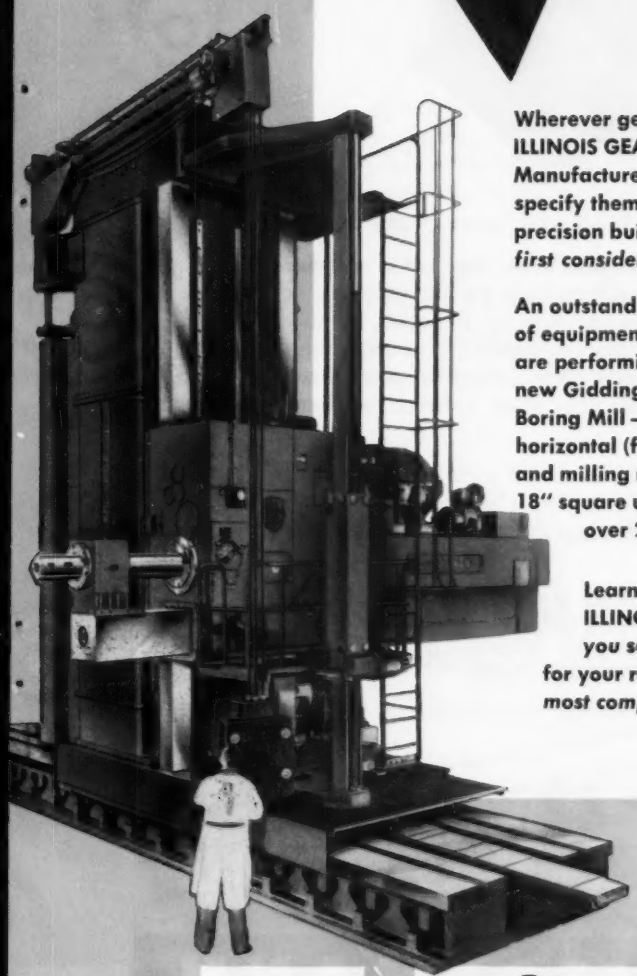
Lodge & Shipley

your LODGE-*ical choice!*

The Lodge & Shipley Company,
3055 Colerain Ave., Cincinnati 25, Ohio.

For more information fill in page number on Inquiry Card, on page 229

Gears For every Purpose



Wherever gears are used, the name **ILLINOIS GEAR** is known and respected. Manufacturers of fine equipment always specify them. **ILLINOIS GEARS** are precision built with *quality as the first consideration.*

An outstanding example of the type of equipment in which **ILLINOIS GEARS** are performing a vital function is the new Giddings & Lewis Model 1210-FUAR Boring Mill — *the world's largest* horizontal (floor type) boring, drilling and milling machine with 10" spindle, 18" square underarm and weighing over 200 tons.

Learn for yourself how **ILLINOIS GEAR** *can help* you select the right gears for your requirements from *America's most complete line of gears.*

Look for this mark ILLS *the symbol on finer gears*

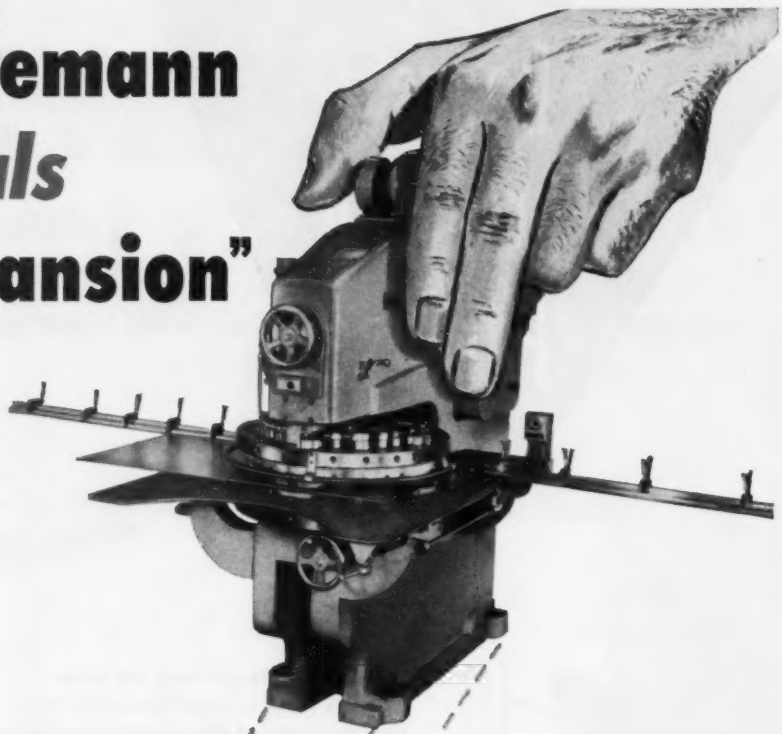
ILLINOIS GEARS

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE
CHICAGO 35, ILLINOIS

ONE Wiedemann *equals* Plant "Expansion"

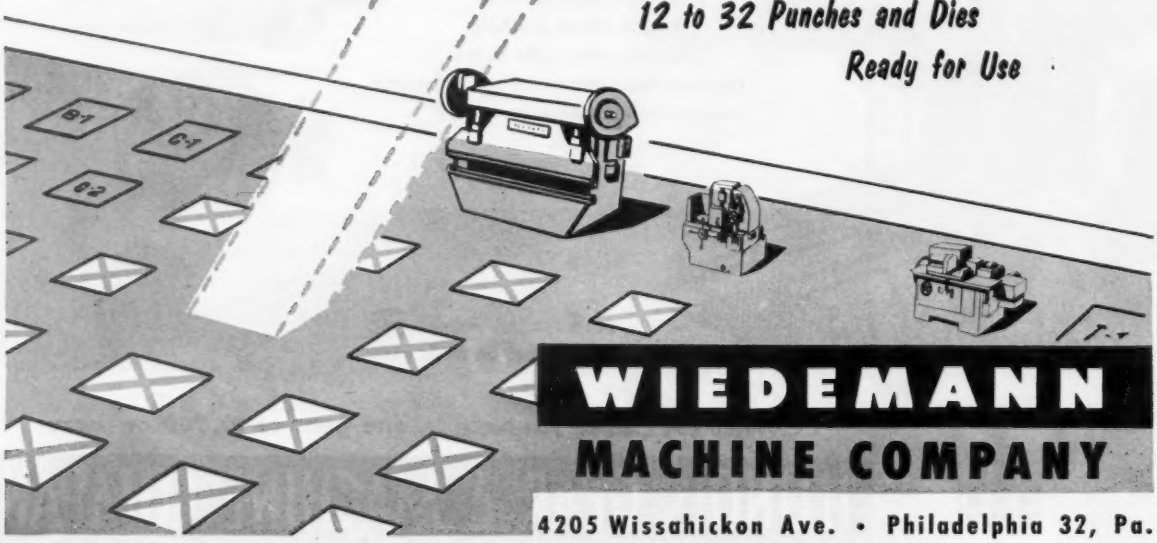


Exaggeration? Not if the experience of Wiedemann users is any criterion.

Wiedemann Turret Punch Presses produce more work in less time and in less space. In numerous plants, one Wiedemann has replaced as many as 12 or 14 units such as single purpose punch presses, layout tables, nibbling machines, etc. And in most cases, the single Wiedemann, in 1/10 the floor space, actually out-produces the multiplicity of conventional equipment. Direct savings of 60% to 90% are commonplace. Machine down-time is practically eliminated; accuracy is improved; valuable floor space is freed; engineering changes become low cost operations. . . .

If you are interested in greater productivity of pierced parts in small to semi-production quantities, such as panels, chassis, truck parts, etc., it will pay you to get the facts about Wiedemann Turret Punch Presses. Send drawings of your work for time study or write for Bulletin 201.

12 to 32 Punches and Dies Ready for Use



WIEDEMANN MACHINE COMPANY

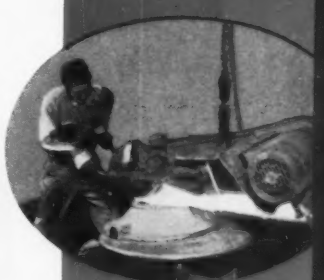
4205 Wissahickon Ave. • Philadelphia 32, Pa.

Here's "What's NEW!" with SIMONDS ABRASIVE CO. GRINDING WHEELS

NEW

IL BOND . . . for longer, faster, heavy-duty grinding

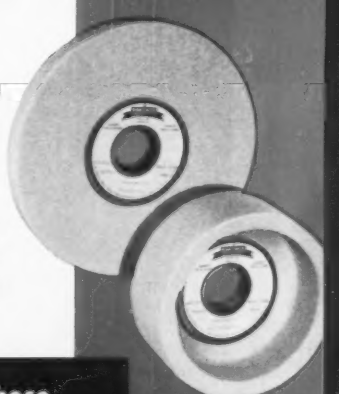
New IL Bond . . . it's in the grinding wheel mix. Special chemicals and compounds added to conventional resinoid bonds provide an *internal lubricant* to increase cutting action and prolong grinding wheel life. For ALL your snagging jobs!



NEW

DA Borolon® TRADE MARK . . . abrasive for resinoid bonded snagging wheels

New DA Borolon . . . an improved, smaller crystal aluminum oxide abrasive for resinoid snagging wheels for floor stand and swing frame grinders . . . has more and sharper cutting edges, gives more production. Use with IL Bond described above.



NEW

SA Borolon® TRADE MARK . . . abrasive for toolroom grinding wheels

New SA Borolon . . . a radically different, friable aluminum oxide abrasive with a unique *single* crystal formation that gives cooler, faster grinding and longer life. Ideal for tool and cutter grinding and horizontal surface grinding.

Send for descriptive catalog bulletins on these new products. Ask for IL, DA or SA bulletins.

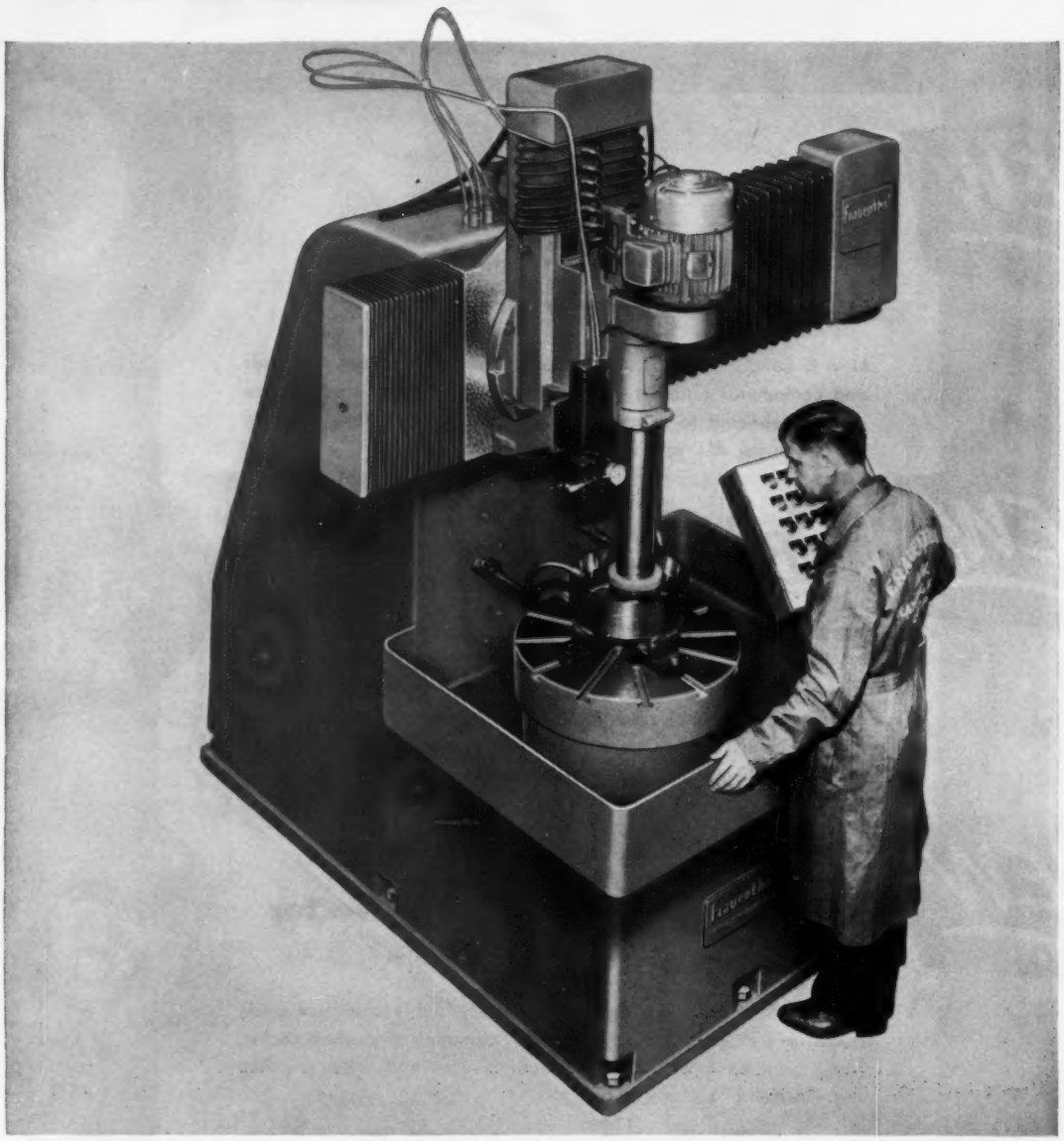
SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCHES: PHILADELPHIA • CHICAGO • DETROIT • LOS ANGELES
SAN FRANCISCO • PORTLAND, ORE.

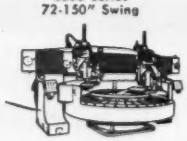
NEW Frauenthal 1200 Series single spindle vertical precision grinders



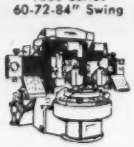
Bird's-eye view of a new Frauenthal 1200 Series (belt-driven) single spindle, vertical precision grinder. These versatile machines are designed to meet a broad range of present requirements . . . are readily adaptable to future requirements.

F **PRECISION PRODUCTION VERSATILITY**

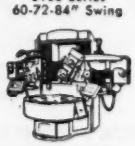
2200 Series
72-150" Swing



1800 Series
60-72-84" Swing

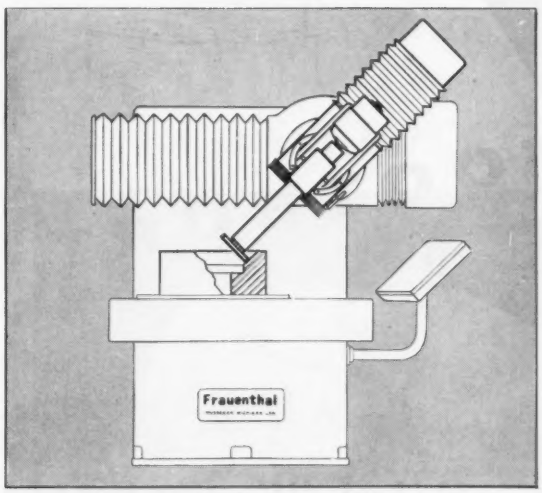


3100 Series
60-72-84" Swing

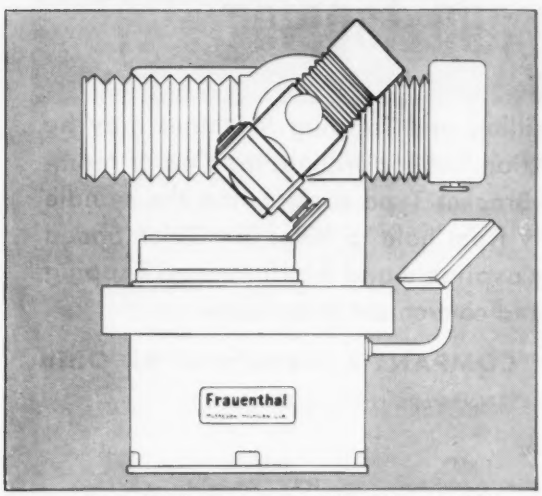


creatively engineered

...accuracy to .000100" at spindle nose



Frauenthal belt-driven Model 1224B and 1236B single spindle, vertical precision grinders have an extreme angle setting of compound at 45°. Versatility such as this permits angle, internal, external and face grinding to millionths-of-an-inch related tolerances.



Frauenthal direct-connected Models 1224D and 1236D are ideal for rotary surface grinding, O.D. surface and angular approach grinding operations. A variety of grinding spindle positions is possible with this head arrangement.

assures uniform, super-precision part after part!

Super-precision is the natural result of overall Frauenthal single spindle, vertical precision grinder rigidity; of proven performance . . . and *continuous* application of advanced grinding techniques.

These new Frauenthal 1200 Series machines are available with choice of belt-driven or direct-connected grinding spindles. Machines with either spindle arrangement are offered with 24" dia. tables x 36" swing and 36" dia. tables x 48" swing capacities inside splash guards. Additional swing can be obtained by removing guards.

Write for free Bulletin

1200 Series
36-48" Swing

Special Grinding Machines using standard Slide Units

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN, U. S. A.

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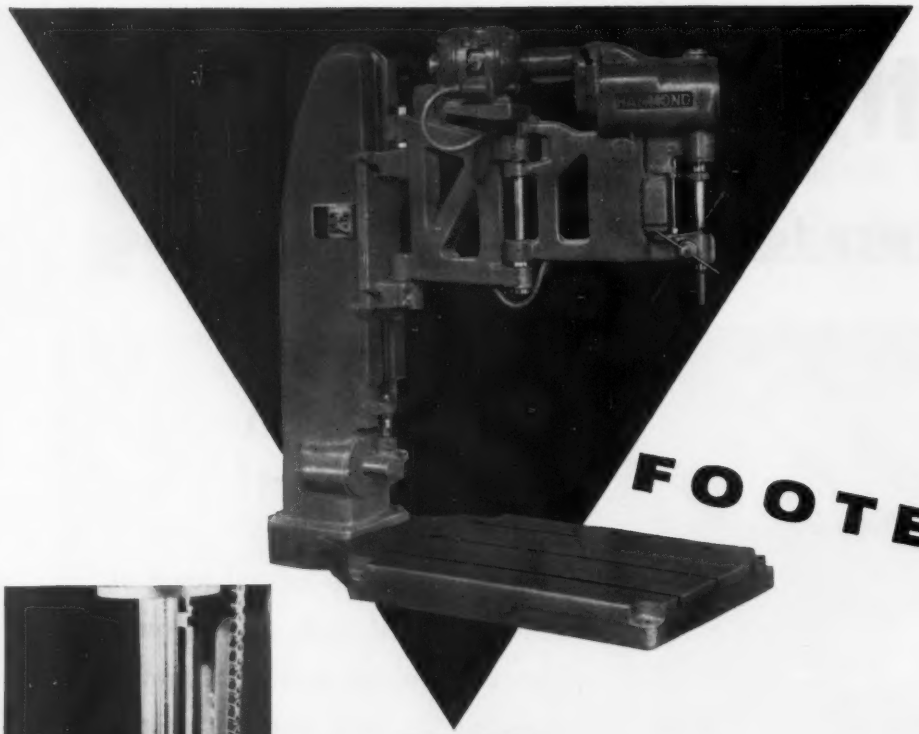
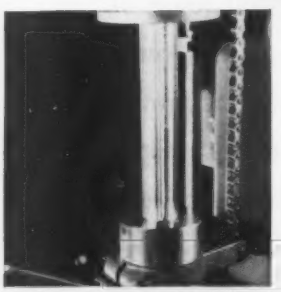
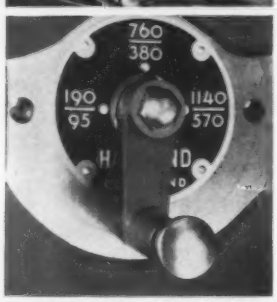
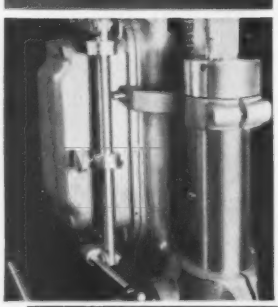


FOOTBURT







for Faster radial drilling and tapping

Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

Write for Circular #7A.

ENGINEERED FOR PRODUCTION

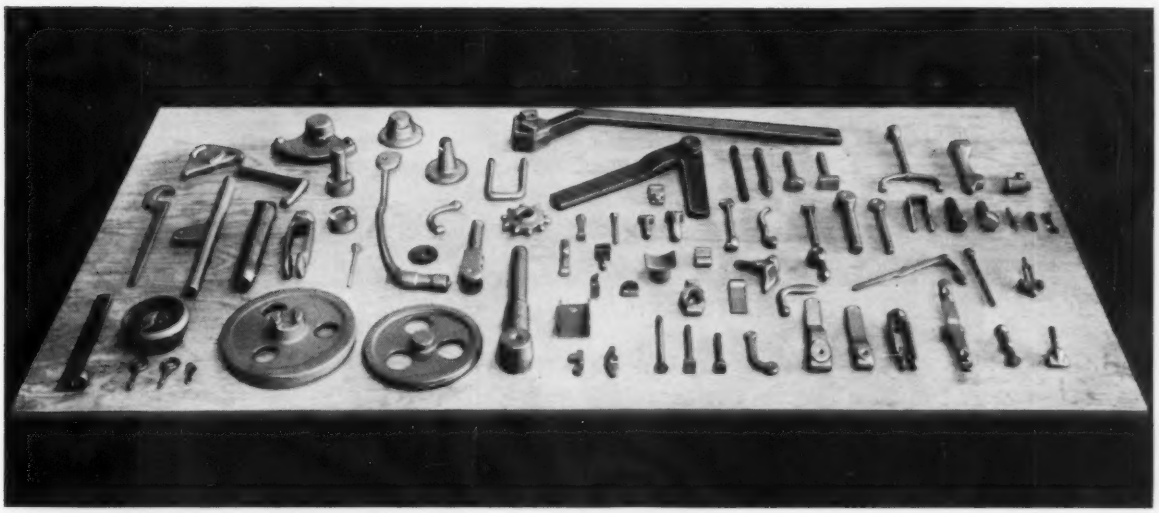
FOOTBURT

MACHINE TOOLS

200 Different Parts Heated for Forging-

Better, Faster and at Much Lower Cost

with TOCCO Induction Heating*



• When progressive production people at General Railway Signal Company installed a 200 kw, 3000 cycle TOCCO machine, they were able to eliminate 7 slot-type oil-fired furnaces and produce better forgings than ever before—at substantially lower costs.

Cost Down—Fuel costs have been reduced from $15.26 to $1.60 per hour with TOCCO. Expensive furnace lining maintenance has been eliminated, and straightening and reheating operations formerly required are no longer necessary.

With oil-fired furnaces all steam hammer operators needed helpers. With TOCCO most of these helper operations have been eliminated.

TOCCO's fast, automatic operation produces almost no scale and achieves uniform temperatures throughout the entire cross section—improving the quality of the forgings and providing increases of up to 40% in the life of the forging dies.

Overall production costs in the forge shop at G.R.S. have been reduced an impressive 35%!

Flexibility—Production runs at G.R.S. range from a low of 15 pieces to a high of over 50,000. Parts from ½ pound to over 25 pounds are heated, merely by changing inductor coils and power control settings.

Better Working Conditions—TOCCO makes the forge shop a better place to work by doing away with noise, dust, dirt, smoke and radiant heat and gases produced by old fashioned furnaces.

If you're looking for a way to produce similar results in your plant, it will pay you to consult a TOCCO Engineer.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept: M-6, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating for Forming and Forging".

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

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time tested designing with MADISON-KIPP zinc and aluminum die castings

The pumping unit is the most vital component in Madison-Kipp high pressure lubricators The one here illustrated is used for pressures up to 2500 lbs.

Free use of iron and steel and brass inserts are features of many lubricator die castings as in the Aluminum Housing shown above.

The exacting service requirements of accurate measuring and forcing devices is something in which we have qualified as experts for nearly sixty years. Perhaps our time tested design formulas may be of help to you.

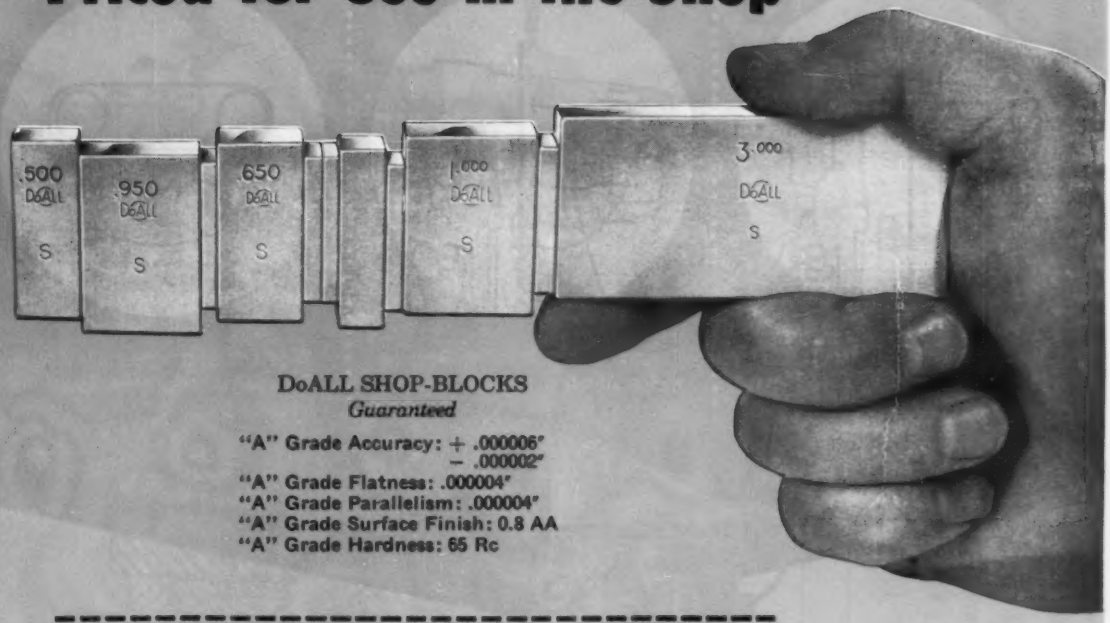
We will be pleased to review your blue prints.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

New "A" Grade Gage Blocks Priced for Use in the Shop



DoALL SHOP-BLOCKS
Guaranteed

"A" Grade Accuracy: + .000006"
− .000002"
"A" Grade Flatness: .000004"
"A" Grade Parallelism: .000004"
"A" Grade Surface Finish: 0.8 AA
"A" Grade Hardness: 65 Rc

SET NO. 860
84 pieces*
Only $265

.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—49 Blocks .101" thru .149"
.050" Series—19 Blocks .050" thru .950"
1.000" Series—4 Blocks 1.000" thru 4.000"
Quarter tenth Series—3 Blocks .100025", .100050", .100075"

SET NO. 380
36 pieces*
Only $130

.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—9 Blocks .101" thru .109"
.010" Series—9 Blocks .110" thru .190"
.100" Series—5 Blocks .100" thru .500"
1.000" Series—3 Blocks 1.000", 2.000", 4.000"
Half tenth Series—1 Block .10005"

Now you can bring totally new accuracies to shop measurements with DoALL SHOP-BLOCKS . . . *guaranteed* "A" grade, yet available at "B" grade "working" block prices.

These blocks are available from stock today. Call your local DoALL Store, or write.

**.050" or .100" steel or carbide wear blocks available at slight extra cost.*

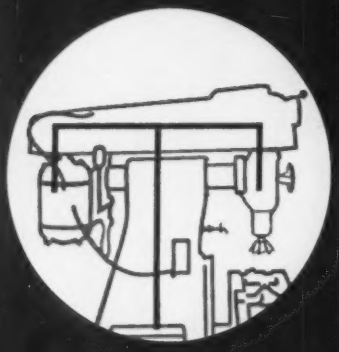
Catalog free on request—send for your copy today.

THE DoALL COMPANY • Des Plaines, Illinois

DoALL

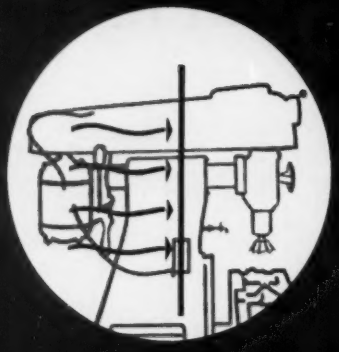
GB-24

BALANCED RIGIDITY



Motor mounted behind column balances weight of head, minimizes deflection.

ISOLATION OF MOTOR VIBRATION



Column acts as baffle, keeping motor vibration away from head.

MORE EFFICIENT POWER TRANSMISSION

Wide belt spacing permits use of B-section V-belt, more wrap-around on pulleys.

mill more accurately with the

U.S. Vertical MILLING MACHINE

The *exclusive* motor mount design of the U. S. Vertical provides balance, rigidity and greater milling ACCURACY! And, check these ADDED features – all designed to aid in close tolerance work.

- Machine weighs 2000 lbs.
- Massive knee, saddle and table
- Extra wide bearing surfaces
- Tested and CERTIFIED ten ways
- Major castings are internally ribbed, normalized and stress relieved.
- Dovetails are deep and hand scraped
- Extra quill, knee, saddle and table travel

Write for your FREE copy of new U. S. Vertical Milling Machine Bulletin.

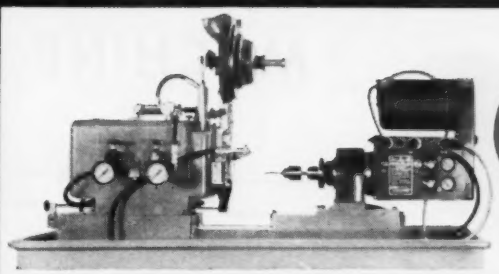
Builders of Milling Machines only

U·S·Burke

MACHINE TOOL DIVISION

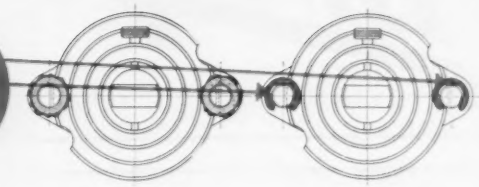
17 Brotherton Road • Cincinnati 27, Ohio

Waldes Truarc Retaining Rings Eliminate Machining and Parts—Cut Assembly Time on Drill and Tapper



Beco Model 410 Drill and Tapper

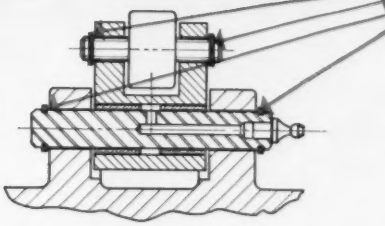
The Batchelder Engineering Co., Inc., Springfield, Vermont uses 4 different sizes of 2 different type Waldes Truarc rings in their new BECO Model 410 Automatic Drill and Tapper. Truarc rings speed assembly, reduce machining, improve design.



ALTERNATE DESIGN TRUARC DESIGN

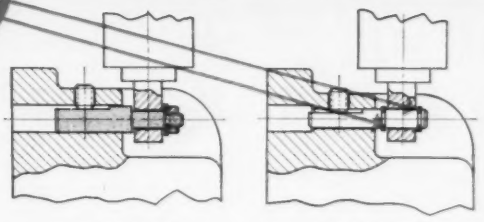
Clamp Cylinder Rod Stop Assembly

Truarc "E" Rings (Series 5133) replace stop nuts in the Clamp Cylinder assembly. They eliminate need for threading 2 rods ...the danger of cross-threading nuts...and costly rejects. Truarc Rings cut assembly time and cost.



Bell Crank Pivot Assembly

Truarc Rings (Series 5100) in Bell Crank Pivot assembly permit grease hole not possible with cotter pin fastener. Use of nuts would have increased machining and assembly costs considerably.



ALTERNATE DESIGN TRUARC DESIGN

Hopper Cylinder Anchor Pin Assembly

2 Truarc Rings (Series 5100) secure and position end of vertical air cylinder. Rings eliminate extra cost of machining 3-diameter pin, threading and undercutting...plus nut and washer. Assembly is quick and sure.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!

WALDES

TRUARC®

RETAINING RINGS

WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N.Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name .....
Title .....
Company .....
Business Address .....
City ..... *Zone* .. *State* .....

MO69

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

The Bridgeport TURRET MILLING MACHINE

... the "greatest value" in the machine tool market

The "greatest value" is not a slogan coined here in Bridgeport by us . . . it is the term applied to Bridgeport Milling Machines universally . . . by those who use them . . . by those who sell them . . . and by those who are waiting for them.

To those who have "Bridgeports" on order, may we say that we are constantly stepping up our production consistent with turning out highest quality machine tools.

It is most gratifying to us to have others go on record, verbally and in writing, to the effect that "Bridgeport" is synonymous with "greatest value." And it is no accident that this expression should be so universally applied to Bridgeport Millers.

Everything connected with the design and building of these machines has had "value" as the objective . . . value in terms of precision . . . value in versatility . . . value in ability to get maximum utility from the use of the "Bridgeport."

"Bridgeports" are within the reach of any shop, small or large. Small wonder then for the recognition and acceptance of these time-tried and proved versatile machine tools . . . the "greatest value" in the machine tool market.

Further facts are available through your nearest dealer or through us direct.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

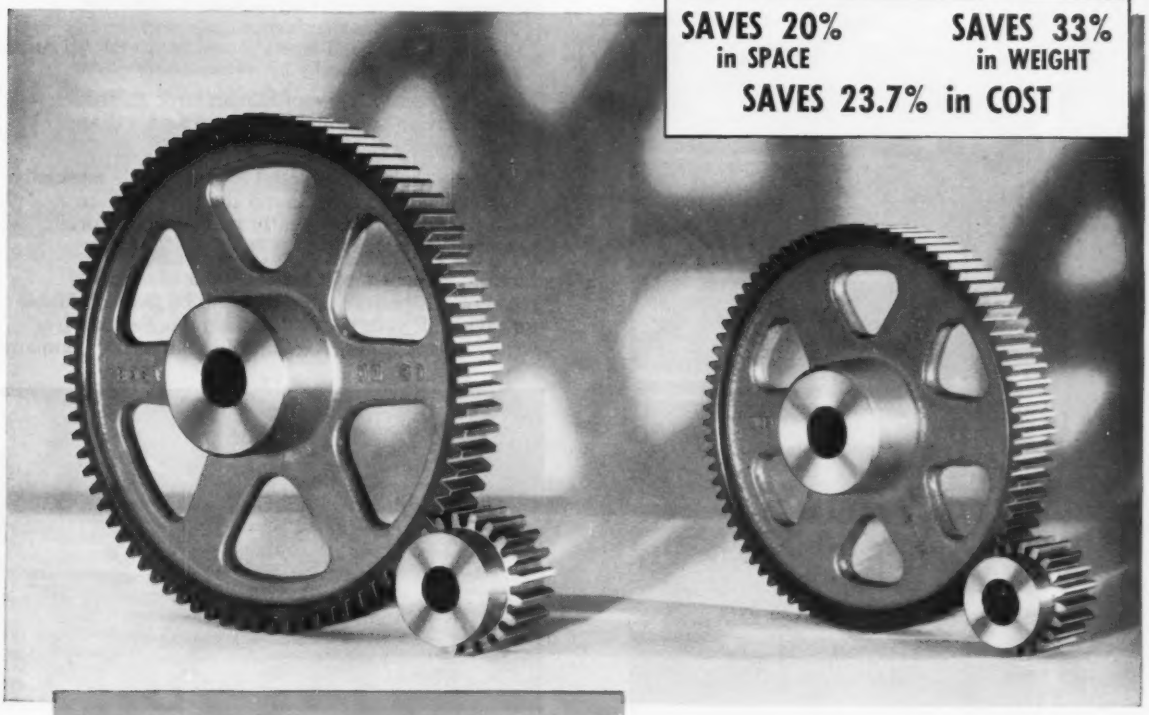
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

They both meet the job specifications . . . but one of these gear sets costs you 23% less

20° PRESSURE ANGLE		COMPARE SAME RATIO	14½° PRESSURE ANGLE	
Pinion	Gear		Pinion	Gear
2"	8"	Pitch Diam.	2.5"	10"
5"		Center Distance	6.25"	
1 lb. 3 oz.	9 lb. 1 oz.	Weight	2 lb. 3 oz.	13 lb. 2 oz.
3.67	14.60	Price	4.72	19.20

SAVES 20% in SPACE **SAVES 33% in WEIGHT**

SAVES 23.7% in COST



BOSTON 20° Pressure Angle GEARS

441 STANDARD SIZES *FROM STOCK!*

SPUR
Steel and Iron
20 to 4 P.
Fine Pitch Brass
64, 48, 32
and 24 P.

MITER
Cast Iron
8 to 2½ P.
Steel
48 to 4 P
Fine Pitch Brass
48, 32
and 24 P.

BEVEL
Steel and Iron
20 to 3 P.
Fine Pitch Brass
48, 32
and 24 P.

SEE CATALOG No. 56 for complete listings

Every engineer knows the quiet-running efficiency and high strength of the 20° Pressure Angle tooth form. For most installations, the 20° P. A. Gear that meets specifications saves an average of 20% in space, weight, and cost over the comparable 14½° P. A. Gear required.

Now, the types and sizes of 20° P. A. Gears you need to make these big savings in your assemblies are *available, anywhere in industrial U. S. A. or Canada,* FROM STOCK at BOSTON GEAR Distributors.

Get details. Start making the savings you've been missing. Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

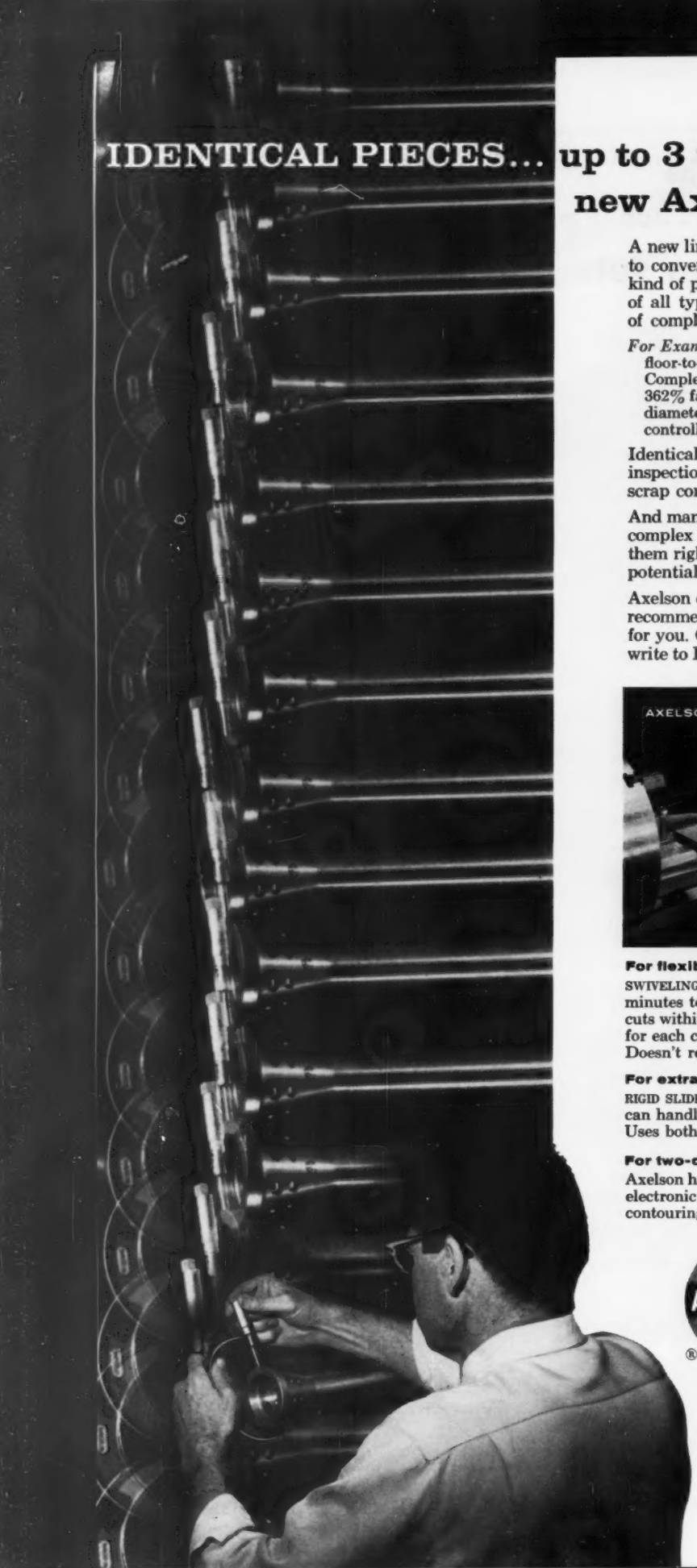
7124
STANDARDIZED TRANSMISSION PRODUCTS

For nearest Distributor

LOOK UNDER "GEARS" in the "Yellow Pages"

"OFF-THE-SHELF" — AT FACTORY PRICES CALL YOUR BOSTON GEAR DISTRIBUTOR

For more information fill in page number on Inquiry Card, on page 229



IDENTICAL PIECES... up to 3 times faster...with new Axelson Tracer Lathes

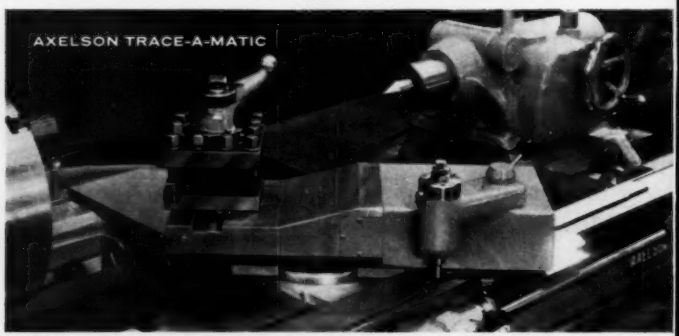
A new line of hydraulic tracing attachments is ready to convert your Axelson engine lathe into a different kind of production tool . . . speed up identical output of all types of work . . . open whole new areas of complex contouring.

For Example: With as few as six forged spindles to turn, floor-to-floor time has been cut in half with a tracer setup. Complex aircraft shock struts have been turned out 362% faster with a simple single-point tool turning diameters, radii, and tapers in one uninterrupted cut, controlled automatically by a template.

Identical pieces . . . free of human error . . . reduce inspection costs and make work scarce for the scrap committee.

And many shops that weren't able to handle especially complex contours have found that tracers take them right in stride – greatly increasing the profit potential of a lathe.

Axelson engineers will analyze your blueprints . . . recommend the tracer use that will be most profitable for you. Call your nearest Axelson representative or write to Dept. MM-6, Axelson Manufacturing Company.



For flexibility and extreme accuracy...

SWIVELING SLIDE, COMPOUND-MOUNTED TRACER. Takes only minutes to replace standard compound. Holds finishing cuts within tolerances of ±.001. Swivels to optimum angles for each contour. Doesn't decrease swing over cross-slide. Doesn't reduce tool slide travel.

For extra-heavy cuts...

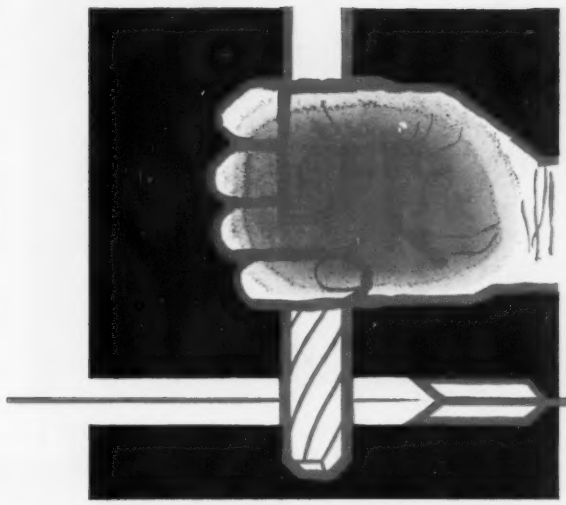
RIGID SLIDE, 45° TRACER. Absorbs maximum cuts machine can handle. Gives operator easy access to work. Uses both flat and round templates.

For two-dimensional tracing...

Axelson has available fully engineered hydraulic and electronic tracing systems to permit two-dimensional contouring, with or without cross-center turning.

AXELSON LATHES

AXELSON MANUFACTURING COMPANY
Division of U. S. Industries, Inc.
6160 South Boyle Avenue, Los Angeles 58, California

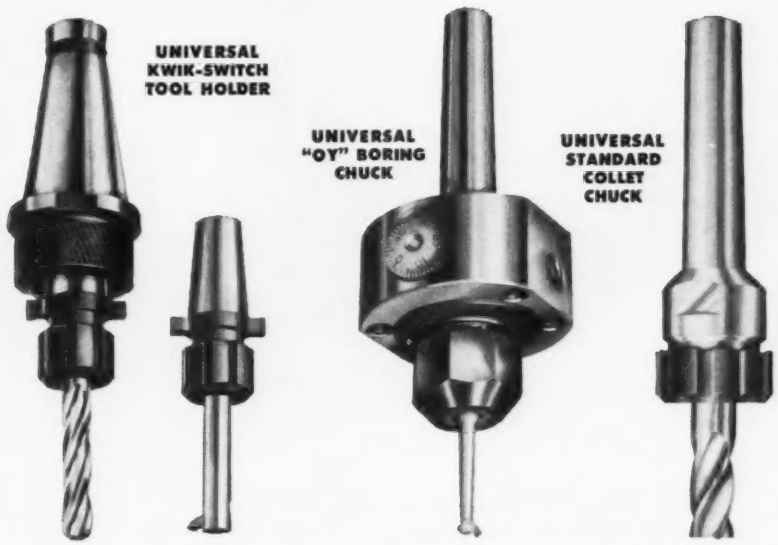


positive
grip

and true-running

tools

ARE CERTAIN WITH UNIVERSAL CHUCKS SUCH AS THESE:



A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. This positive grip, plus the precision manufacturing of all Universal chucks, keeps tools running true to .001" within an inch from the nose of the chuck. Our simplified chuck design eliminates auxiliary bearings, resulting in low cost to you. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. For complete information on these three or other Universal chucks, write the office nearest you: Universal Engineering Sales Co., 1060 Broad St., Newark, N. J., 5053 Sixth Ave., Kenosha, Wis., or our home office in Frankenmuth.

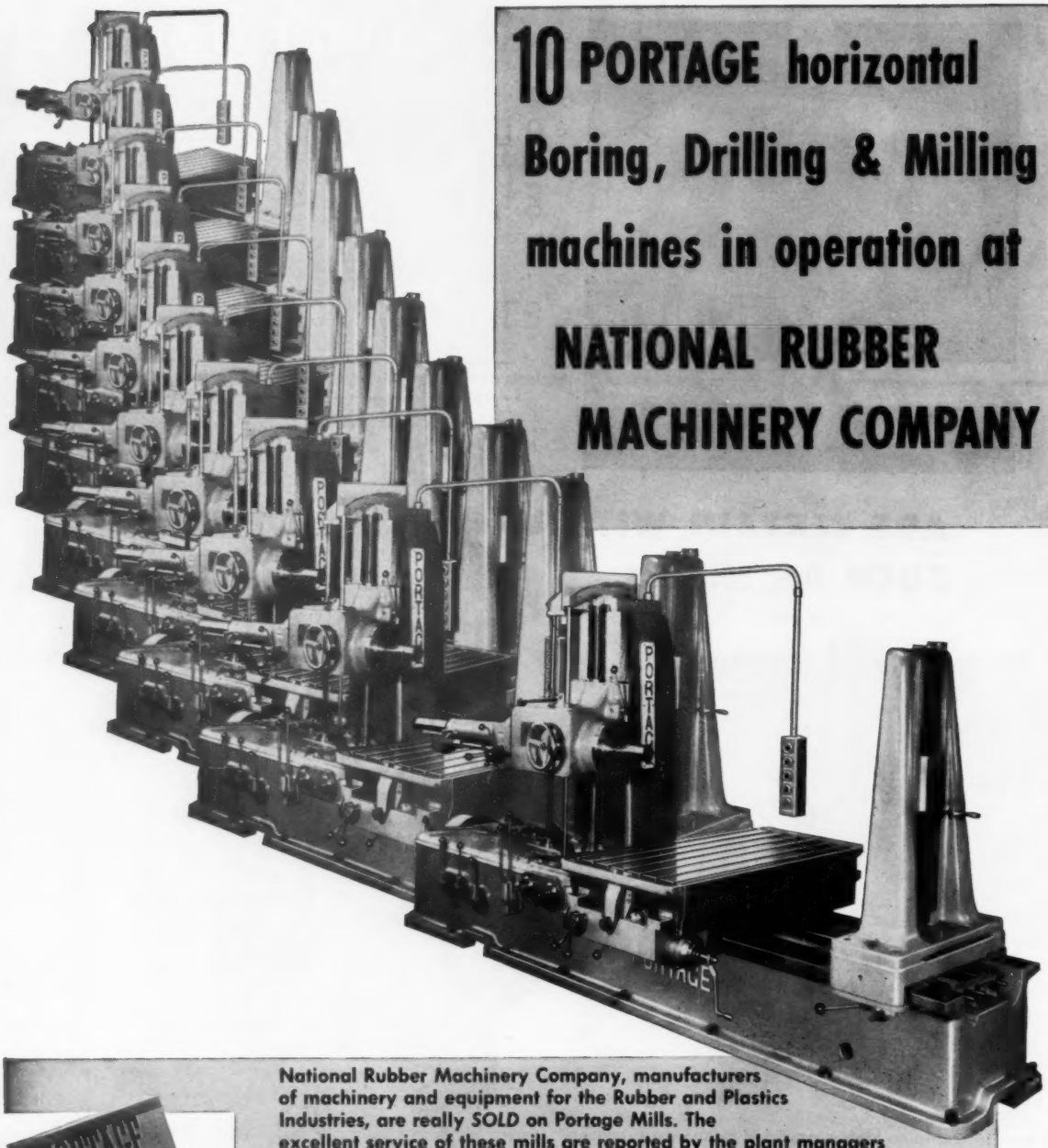
UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2, MICHIGAN

195

For more information fill in page number on Inquiry Card, on page 229

10 PORTAGE horizontal Boring, Drilling & Milling machines in operation at NATIONAL RUBBER MACHINERY COMPANY



National Rubber Machinery Company, manufacturers of machinery and equipment for the Rubber and Plastics Industries, are really *SOLD* on Portage Mills. The excellent service of these mills are reported by the plant managers at Columbiana, Ohio and the Akron Division plant. This large installation certainly represents a vote of confidence for the performance of Portage Mills . . . and speaking of confidence . . . many leading manufacturers have come to realize that the ruggedness, versatility and low maintenance cost of Portage Mills makes them the best buy . . . and remember . . . their initial capital investment cost is less, without the sacrifice of quality. Write for complete information . . . TODAY.

THE Portage MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

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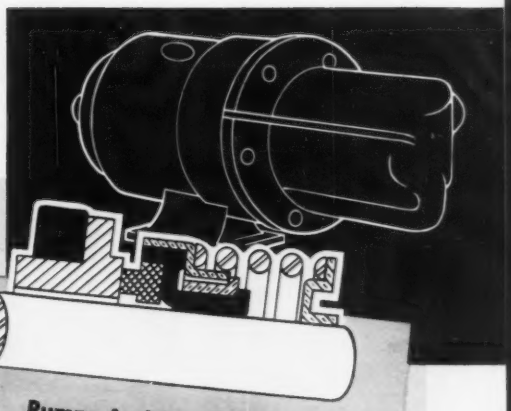
Machine Tools And Power Transmission Equipment

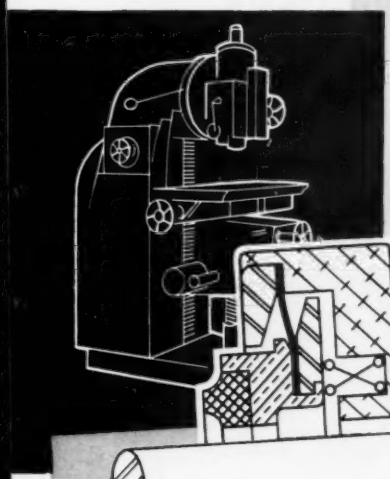
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

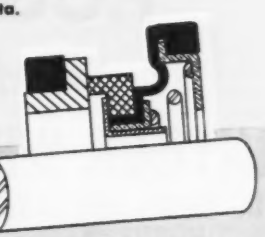
A Complete Line
GITS SHAFT SEALS
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

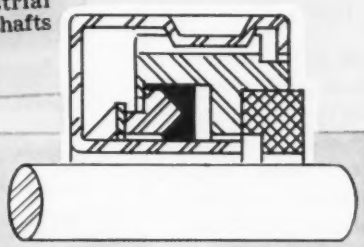
1858, South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.

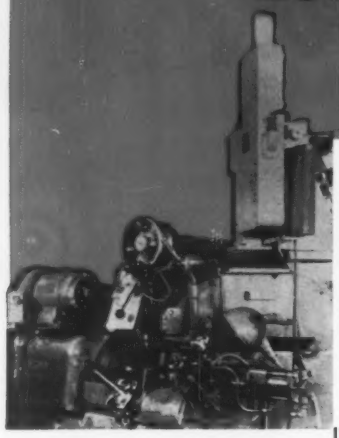


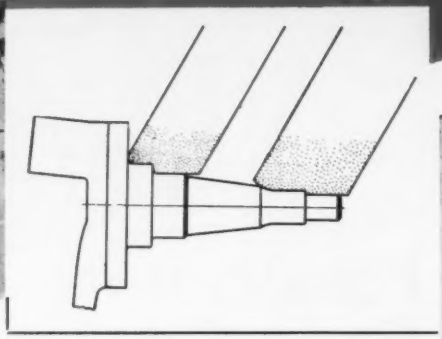
Aircraft Engines And Accessories

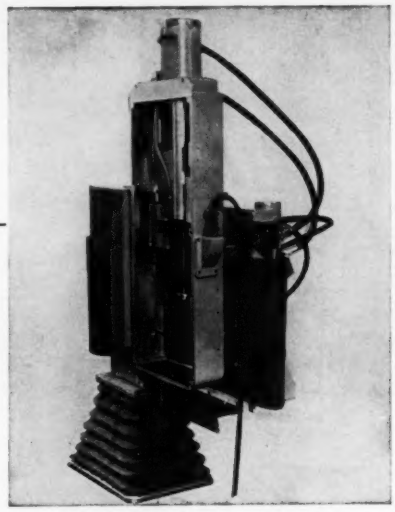
STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.

GRINDING WHEEL PROFILES never before possible

ON CYLINDRICAL GRINDERS







with the new

HOGLUND

Model 86

CONTOUR WHEEL DRESSER

THE DRESSER WITH ENLARGED SYNCHRONIZED TEMPLATES

Now, with the Model 86, any complex contour can be formed on the grinding wheel, limited only by the size and shape of the Diamond. If the Diamond can enter into the profile, the profile can be dressed —in fact, any contour desired can be continuously and accurately dressed in one automatic cycle! Instead of single template bars, Model 86 uses a pair of enlarged synchronized templates to obtain the most complex contours. Model 86 insures absolutely UNIFORM peripheral contour movements—giving profiles heretofore considered impossible on Cylindrical grinders. Here is perfect contour grinding accuracy through correct dressing of abrasive wheels, the HOGLUND way of practically eliminating skill in production contour grinding.....

Check these features of HOGLUND CONTOUR WHEEL DRESSERS

Precision

Automaticity

Will dress any angle on the grinding wheel, perpendicular as well as horizontal.

Not limited to shallow angles and profiles but will dress any angle up to perpendicular to the grinding spindle can even undercut grinding wheels, if necessary).

Eliminates necessity of skill in contour grinding.

Set up time negligible. No skill required.

Diamonds optically set in Microscope. No adjustment required on machine when changing diamonds, so repetition within a tenth is possible.

Uniform peripheral dressing speed of diamond.

HOGLUND FOR ACCURACY

HOGLUND

341 Snyder Ave., Berkeley Heights, N. J.

ENGINEERING & MANUFACTURING CO.

7 Big Advantages! in this

This 113' pre-enameling machine was dry cycling four days after delivery. Capacity 100 100-lb. racks per hour. Overall height of lift only 13'.

WAGNER PRECISION AUTOMATIC

INCREASED LOAD CAPACITY

PRACTICAL FLEXIBILITY

LOWER PRODUCTION COSTS

REDUCED MAINTENANCE

100% USER ADJUSTABILITY

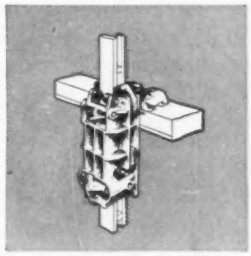
SIMPLIFIED INSTALLATION

IMPROVED PLATING QUALITY

This modular precision electroplating machine is a big subject. Please send for our technical bulletin, learn all the facts, compare—or call the Wagner Man in your area. He'll study your problems and help you achieve better plating at lower costs.

Any day of the week you'll see us lift a 3200 pound automobile with the elevating mechanism of our standard automatic plating machine. That's just to dramatize the dynamic lift capacity of our modular type machine. This excessive capacity simply means that deflection under normal loads is minimum, thus strain on alignment mechanisms is eliminated, wear and downtime is reduced to the vanishing point. Your own personnel—any mechanic—can make precision adjustments of critical transfer members, including the main lift boom, carrier lift angle assemblies and carrier rail support brackets. Maintenance is simple as standard gear racks and pinions are used throughout the entire elevator mechanism (altho capacity can be increased 50% by substituting our heavy duty rack). Hardened guide rollers have positive lubrication—or central lubrication may be installed at low cost.

Here's how you get low cost installation and servicing, even later alterations. All details are interchangeable, precision drilled and machined, preassembled. Our modular design permits easy lengthening or shortening for long term production changes; parts, assemblies, even sections may be replaced. Every part is drilled, reamed, tapped and milled in special co-ordinated fixtures; sections are assembled in giant jigs for fool-proof self-aligning. A single hydraulic power unit interconnected to two hydromotors with micro adjustment of acceleration and deceleration permits work carriers to be lifted, transferred and deposited gently without jarring or loss of parts.



Typical pre-assembled single station elevator housing ready for bolting through jig-drilled holes in main carriage. Note adjustable roller guide brackets.

433 MIDLAND AVE., DETROIT 3, MICHIGAN

CHICAGO • CINCINNATI • CLEVELAND • INDIANAPOLIS • NEW YORK • ROCHESTER • GRAND RAPIDS

Wagner BROTHERS INC.

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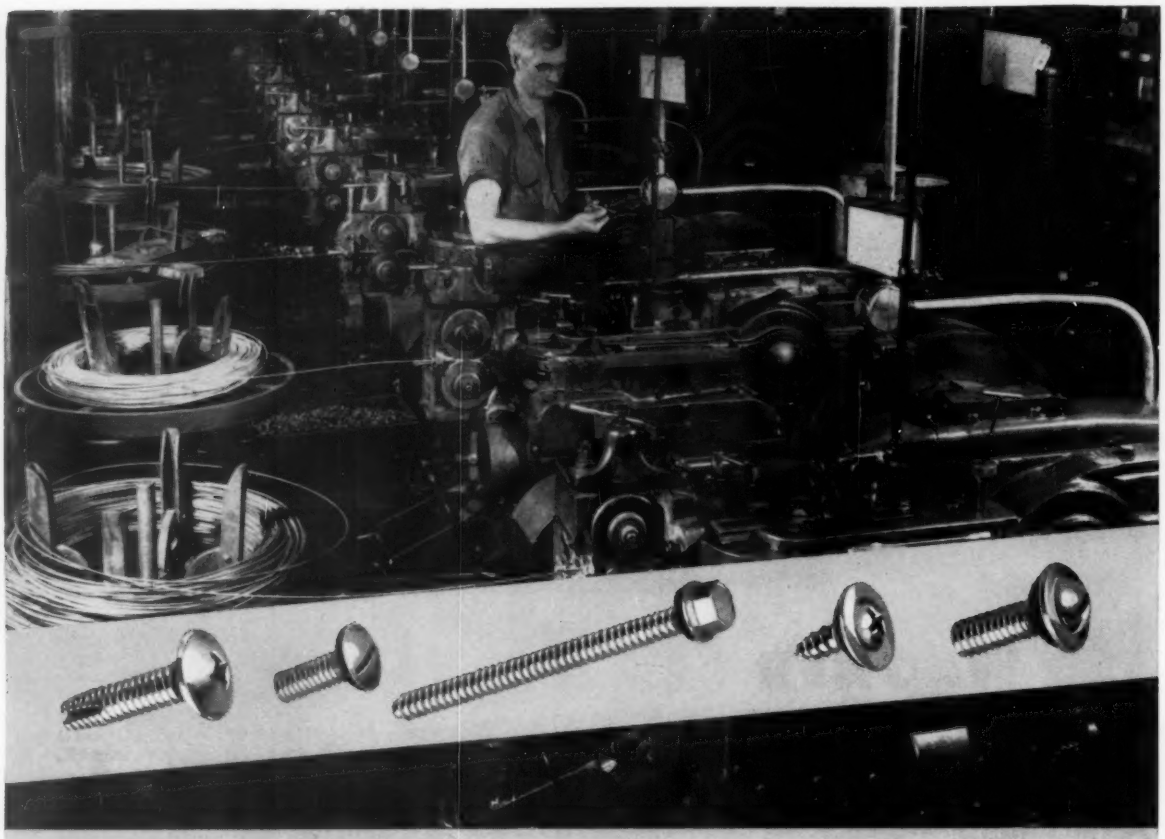
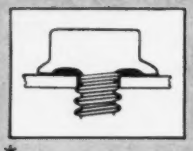


Townsend Cold-Forges New *Tuff-Tite** Line On National Headers



* Neoprene washer trapped under head of TUFF-TITE fastener seals hole—acts as cushion.

Townsend Company, New Brighton, Pennsylvania, 141-year-old manufacturer of rivets and fasteners, has been relying upon National Headers to cold-forge most of its output for the past 26 years.

Townsend continually applies its vast experience to the up-to-the-minute fastener requirements of its customers. The company's operating people find the rigidity, ruggedness and overall ability of National Headers particularly valuable in cold-forging *by the millions* Townsend's new line of TUFF-TITE leakproof fasteners.

If *you* need to make metal parts faster, stronger and at lower cost, may we work with you? Send us your prints and samples, or better yet, accept our invitation to come to our plant. *Here we can approach tomorrow's new and better ways of forging metal parts in the light of methods and ideas which our people are already developing and testing today!*

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO—SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago

0A

9" column 3'-4' arms

1A

9"-11" column 3'-4'-5' arms

3A

13"-15"-17" column 4'-5'-6'-7' arms

4A

19" column 6'-7'-8' arms

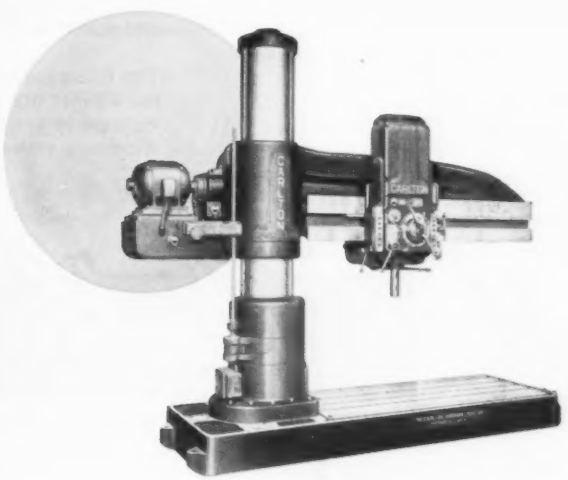
5A

22"-26" column 7' to 12' arms

Carlton

specialists in radial drills

Carlton has specialized in radial drill research, engineering and manufacturing since 1916.
Our close contact with—and intimate knowledge of industry's drilling requirements—have produced a wide line of the most modern and up to date radial drills. Made in arm lengths from 3-ft. to 12-ft., column diameters from 9" to 26".
Programming, pre-select and manual speed-feed controls, plus special bases, tables, and jigs available for additional productivity. For further information, send today for free descriptive bulletins.
The Carlton Machine Tool Co., Cincinnati 25, Ohio.



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81-Block
REFERENCE SET

VK "*Quality in Millionths*"

VAN KEUREN
RECTANGULAR GAGE BLOCKS

Thirty-eight years of experience in manufacturing gage blocks plus the finest in modern measuring instrumentation produce the *"Quality in Millionths"* evident in VK rectangular gage blocks.

These gages are the end product of many skills developed over a long period of time. Final accuracy is controlled by absolute measurement of our master standards on the latest design Zeiss Interferometer, and by comparison with masters calibrated by Interferometry at the National Bureau of Standards, Washington, D.C. VK gage block measurements are made in a modern Gage Room in which temperature is held to 68° ± .1°F. Surface finish is inspected by a Zeiss Interference Microscope.

Van Keuren rectangular gage blocks are offered in Class A (± .000004") and Class B (± .000008") accuracy. They are guaranteed for length, flatness, parallelism, surface finish, hardness and stability. A certificate showing the exact size of each block is furnished with all Class A sets.

The tolerance on VK microgages has again been halved, and all microgages are now furnished to + .000008" — 000000", at no increase in price. Tolerance is all plus to provide necessary wear allowance on working blocks.

VK MICROGAGES

Set M35L Price $120.00

For "working" gage blocks we recommend VK 7/8" diameter microgages in the new Class "A" (+ .000008" — .000000") accuracy. These gages are available in 16 sets, including the 35 block set shown above, and the valuable set M81 at $250.00.

VK

38th YEAR

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

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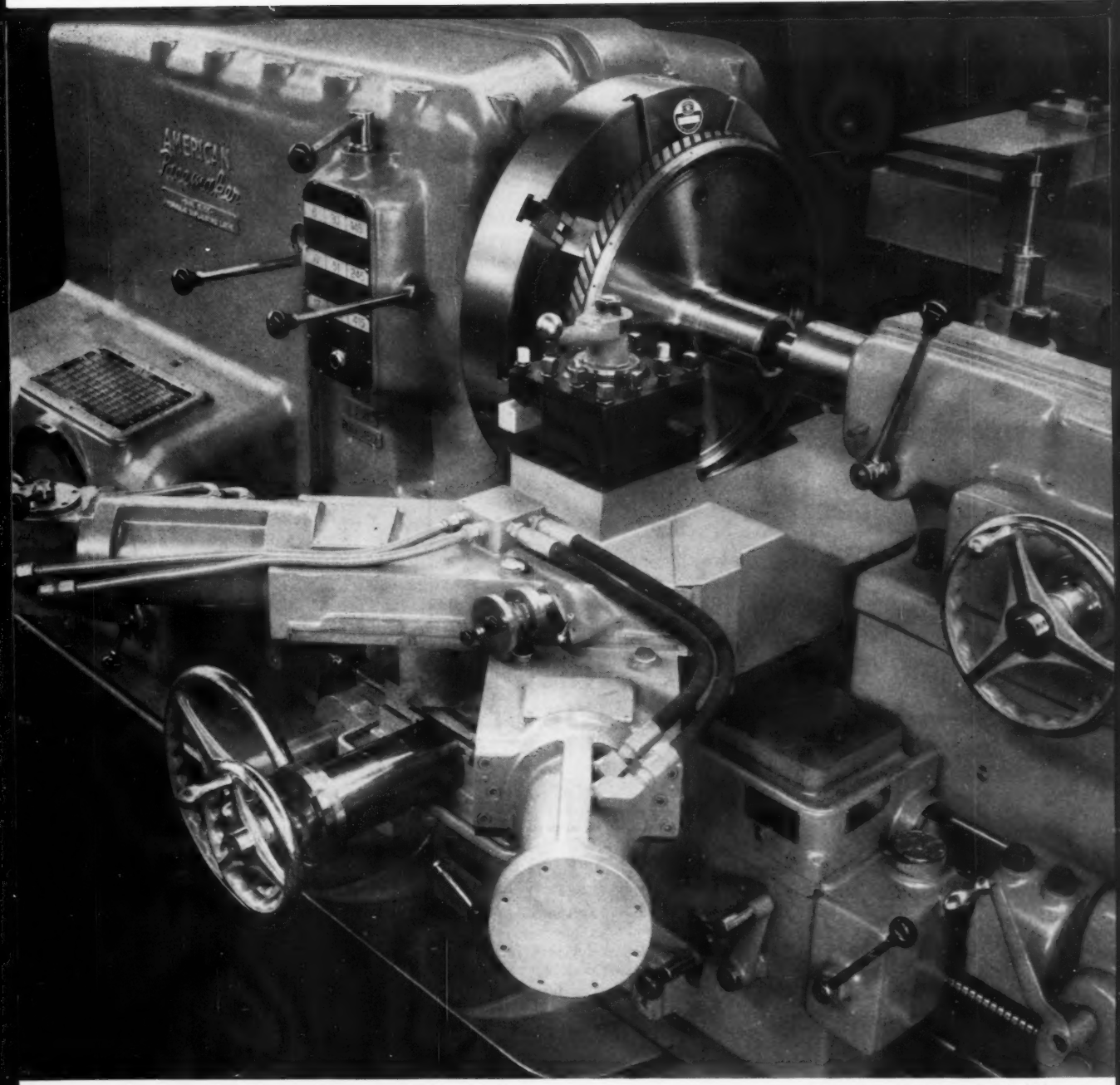


Photo courtesy of The American Tool Works Company

THE LATHE — *American Pacemaker 25" Style "G" Hydraulic Duplicating Lathe*

THE OPERATION — *Machining a jet engine compressor wheel*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Niagara Falls, N. Y.
Crane Packing Co., Morton Grove, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Discs
Carborundum Co., Niagara Falls, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Niagara Falls, N. Y.
Crane Packing Co., Morton Grove, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Watson-Stillman Co., Roselle, N. J.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

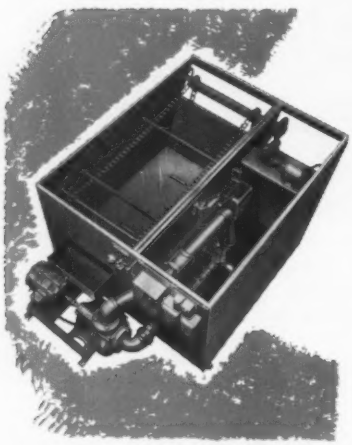
ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady, N. Y.

BIG in Capacity
HIGH in Filter Efficiency
SMALL in Micro-Inch Particle Size

Delpark Filter-Matic

TUBULAR SCREEN VACUUM FILTER



The response to DELPARK'S FILTER-MATIC vacuum filter has been tremendous. The reasons for such interest is obvious. The DELPARK FILTER-MATIC occupies a minimum of floor space, yet it handles an extremely high rate of flow. With these features, DELPARK engineering has achieved such a high degree of filtration that low micro-inch production finishes are easy to attain.

Permanent filter media used in the DELPARK FILTER-MATIC may be used without filter-aid. Where absolute filtration is required, precoat may be used as needed. Capacities 5-1000 g.p.m.

Write giving complete details for more information on DELPARK FILTER-MATICS *as applied to your filtration problems.*

Delpark

. . . FIRST in Filtration Advancements

INDUSTRIAL FILTRATION COMPANY
15 INDUSTRIAL AVENUE
LEBANON, INDIANA

Automatic feeding and setting with...

T-J

Speeds up riveting and clinching!

It's a quick step to *faster assembly* and *reduced labor costs* when you put T-J Rivitors and Clinchors in your production picture! These performance-proved machines are suited to a wide range of assembly jobs for aircraft, automotive, farm machinery riviting jobs of all kinds.

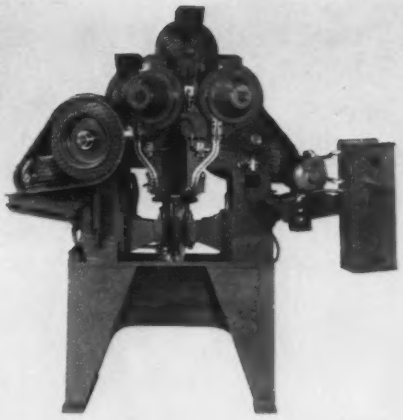
T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to 7/8" long. Throat depths 8" to 36".

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

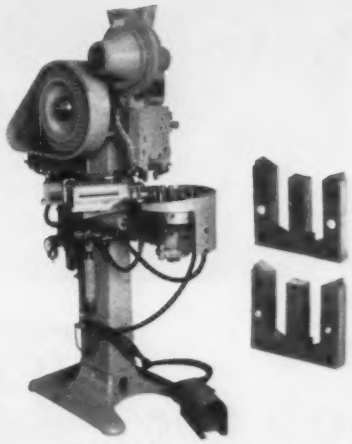
Send today for these helpful references: Rivitor bulletins 646 and 555 . . . Clinchor bulletin 555. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON

RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

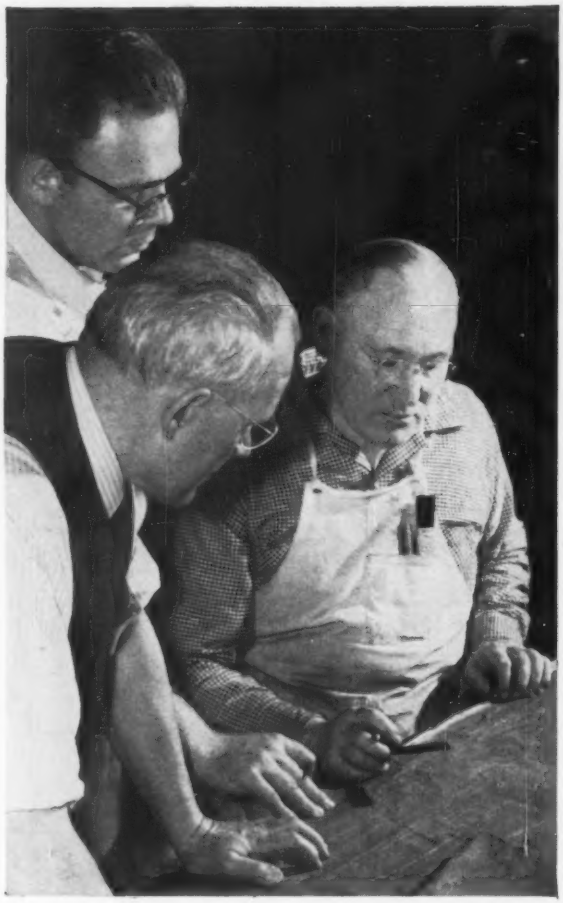


RIVETS 4 AT A TIME! Special quadruple riveting unit, incorporating two Model "RR" Twin Rivitors, mounted on a special welded steel base. Equipped with air-operated hold down mechanism and a safety air trip arrangement. Tooled for riveting left hand and right hand automotive muffler bracket assemblies.



SPECIAL TWIN RIVITOR! Tooled for 6 station indexing fixture, incorporating automatic clamping and ejecting mechanisms, for riviting laminated armature assemblies.

T-J CLINCHOR adaptable to a wide range of clinch nut setting problems. Gravity feed model shown here.



it's a job for CDT

Faced with a special tooling job? Stymied by a tough problem? Would 50 years of experience help? Then the logical answer for you is to send it to Columbus Die-Tool! CDT specializes in tools, jigs, fixtures and also special machinery, designed and built to produce your products better, faster, and more economically.

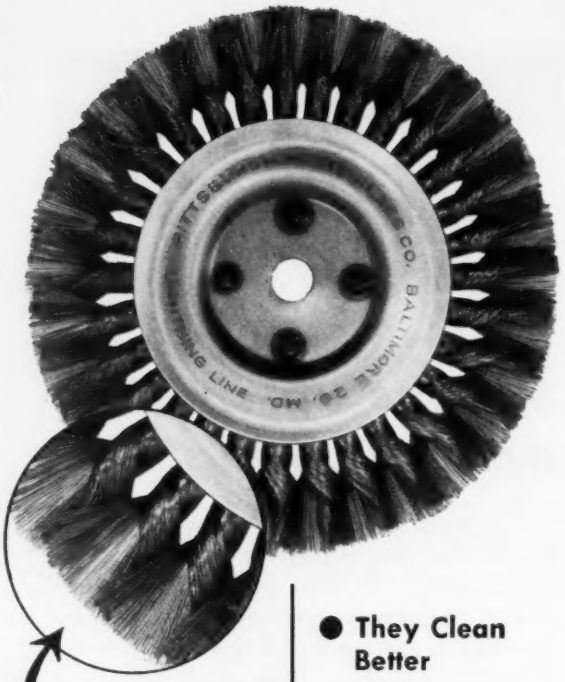
That's why so many of the nation's leading manufacturers avail themselves of the specialized services of Columbus Die-Tool. Perhaps CDT can solve your tooling problem and help you make your product . . . better for less.

Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

Pittsburgh's Knotted Brushing Wheels are better balanced!



- Exactly the same number of high-grade wires in every knot

- They Clean Better
- Wear Uniformly
- Last Longer

Pittsburgh Knot Type brushing wheels are perfect for cleaning welds, removing scale or rubber, and cleaning parts where penetration brushing is required. They wear uniformly and cause less vibration because they're better balanced. The special wire used is the fastest cutting, with the longest life, that can be made.

• **We have been engineering,** designing and building brushes for a wide variety of industries for many years. Our long experience can save you time and money. Write Pittsburgh Plate Glass Company, Brush Division, Dept. M-67, 3221 Frederick Avenue, Baltimore 29, Maryland.

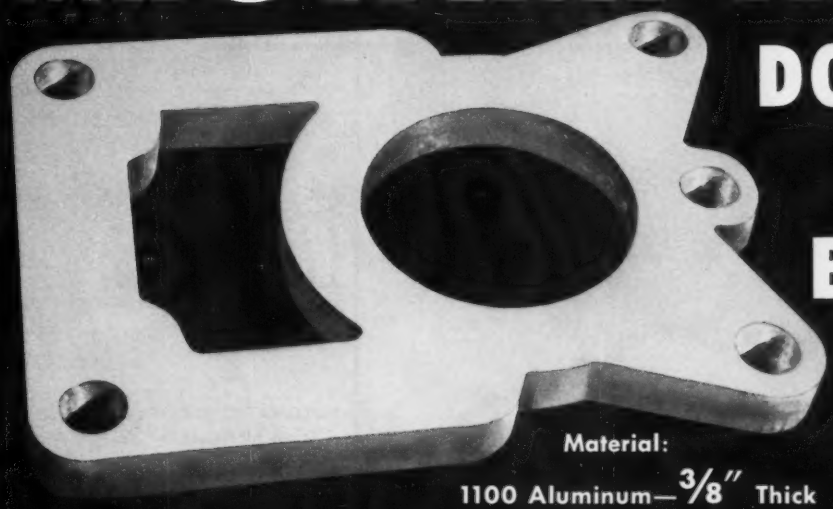
PITTSBURGH *Power Driven* **BRUSHES**

BRUSHES • PAINTS • GLASS • CHEMICALS • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN INDUSTRIES LIMITED

WILL STAMPINGS DO YOUR JOB BETTER?



Material:
1100 Aluminum—3/8" Thick

CASE HISTORY:

Redesign from casting to stamping cuts piece price 66%... tooling cost 53%

★ **BREAKAGE ELIMINATED**

Wrought aluminum alloy gives greater strength characteristics, eliminating breakage which occurred with the original cast part.

★ **MACHINING ELIMINATED**

Blanked and pierced part is complete as pictured. No additional machining of holes or top and bottom surfaces is required. End result is a better part at lower cost.

★ **COST REDUCED**

Piece price reduced 66%. Original cost of the casting plus necessary machining was $1.45 each in lots of 1000. *Cost of stamping is 50¢ each.*

Tooling cost reduced 53%. Original cost of pattern and drill jig was $301.00. *Tooling for stamping cost $140.00.*

WILL STAMPINGS DO *YOUR* JOB BETTER?

Analyze your production parts and check with...

DAYTON ROGERS
Manufacturing Company

MINNEAPOLIS 7M, MINNESOTA

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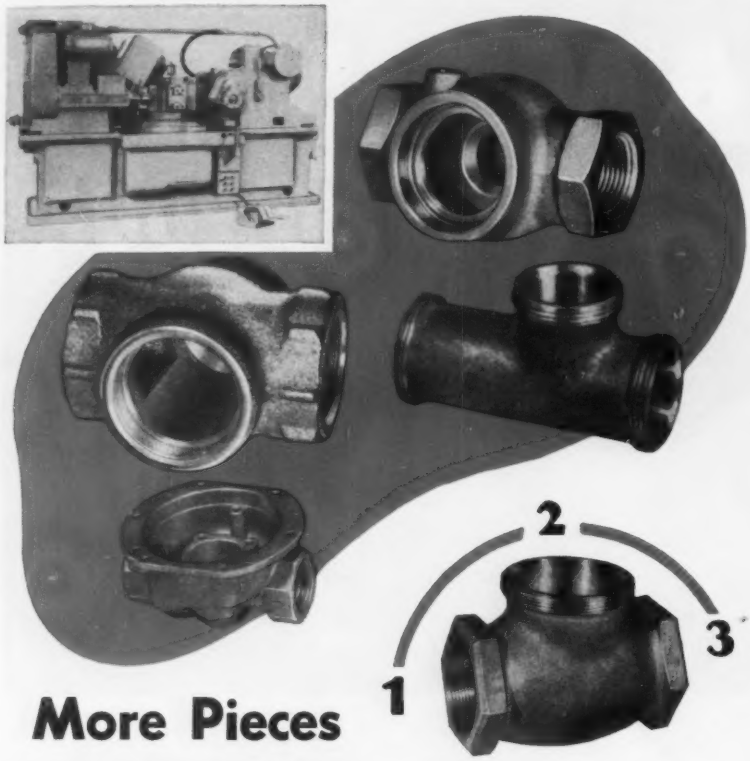

More Pieces COMPLETELY *finished in less time on*

GOSS & DeLEEUW AUTOMATIC CHUCKERS

This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & De Leeuw feature provides for finish machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

●

Send for illustrated literature which fully describes this recent Goss & De Leeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY PRODUCTION

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

BABBITT
American Crucible Products Co., Lorain, Ohio
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES
Haynes Stellite Co., Kokomo, Ind.
New Departure Div., Bristol, Conn.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES
Fafnir Bearing Co., New Britain, Conn.

ROCKWELL-BUILT

DELTA 11" metalworking lathe

"You can't beat it for precision work"

say Sam and Charles Lentini, Co-Owners, Jacy Manufacturing Co., Brooklyn, N.Y.

ACCURACY TO 0.0003 INCH. The Lentinis use their Delta 11" Lathe to machine precision instrument parts and components for the aeronautical and electronics industries where extremely close tolerances are demanded. Their Delta meets these exacting demands down to plus-minus 0.0003-inch tolerance. Sam Lentini points out that the lathe's L-00 tapered key drive chuck insures a positive grip on the work.

SHIFTS OPERATIONS QUICKLY. With their Delta 11" lathe, the shift from turning or boring to threading or tapping is done with complete ease. There's no time lost in changing set-ups. "The big, legible dials on the Delta lathe make precision machining fast and easy," explains Charles Lentini.

CONSISTENT QUALITY. Jacy men get the same high quality results in metals ranging from brass to titanium—in lots as large as 30,000 or small as 10. As Sam Lentini points out, "For doing precision work in small lots or large, you can't beat the Delta 11" metalworking lathe."

PAYS ITS OWN WAY. "In a shop like ours with a variety of work, every tool must be versatile enough to pay its way on every job," says Charles Lentini, "and *we have yet to find a precision job that our 11" Delta couldn't do.*"

SEE THE ENTIRE DELTA 11" METAL LATHE LINE. **Compare—and make up your own mind. Your Dealer is listed under "Tools" in the Yellow Pages of your phone book.**

Send coupon for all the facts!

Delta Power Tool Division, Rockwell Manufacturing Co.
614F N. Lexington Ave., Pittsburgh 8, Pennsylvania

☐ Please send Delta Industrial Catalog on entire Delta 11" Metal Lathe Line.

☐ Please send name of my nearest Delta Dealer.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____

DELTA ROCKWELL

another product by **ROCKWELL**

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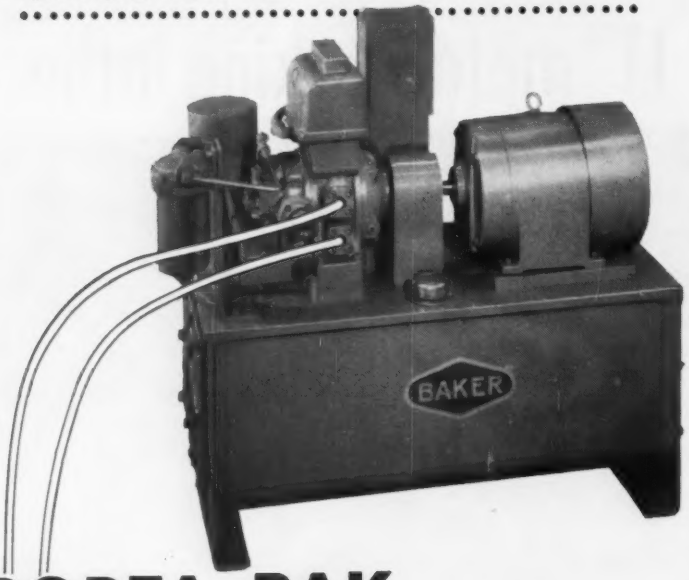
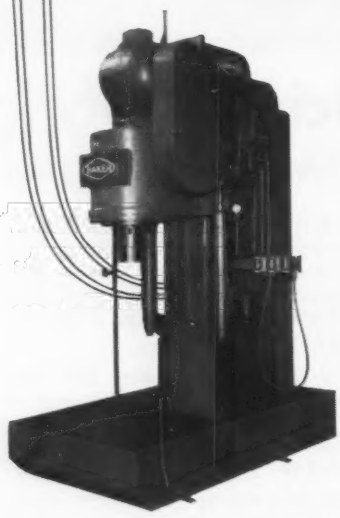
another BAKER bonus



PORTA-PAK
. . . SERVICE IS A SNAP



Here's a *separate* hydraulic power source that's attached to the machine only through the hydraulic lines. So it can be placed in any convenient location . . . and it's always easily accessible for service. A completely self-contained unit. Porta-Pak can be furnished on all Baker specials — or on Baker Basics, for automation with *standard* machines.

BAKER
AUTOMATION
Best in the long run
Practical in the short run

CHECK AND MAIL FOR DATA

( ) Porta-Pak hydraulic power source
( ) Exclusive twin-pull hydraulic feed cylinders — compact, easily accessible.
( ) Hardened, ground steel or cast iron ways — durable
( ) Big ball bearings throughout, rugged construction

BAKER BROTHERS, INC.
Dept. M-657, Toledo 10, Ohio

Yes, tell me more about these Baker Bonuses.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless
American Crucible Prod. Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

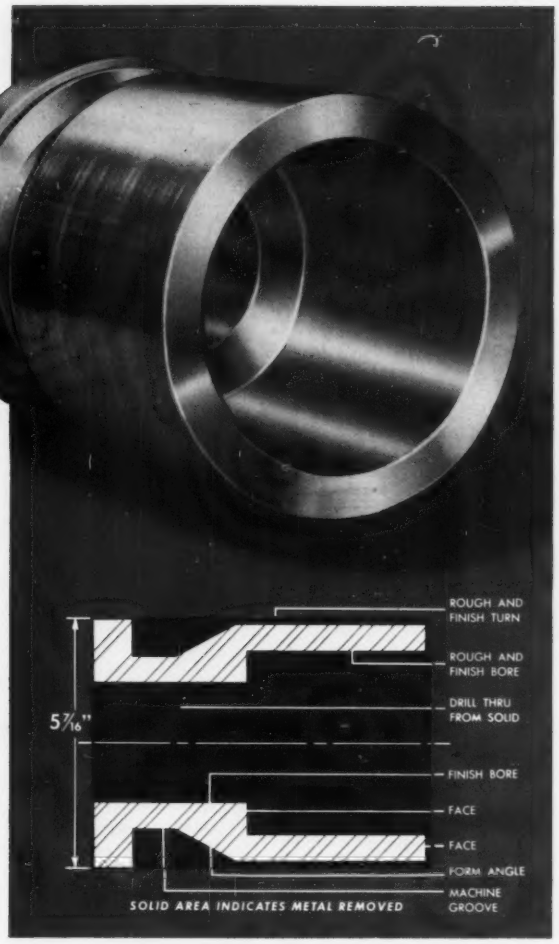
BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS
South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.



Let me show you how one of our P & J Automatics

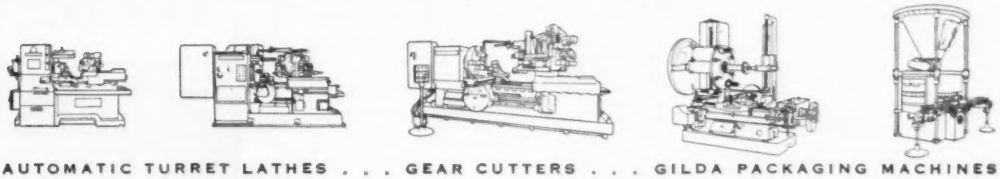
Hogged Out Over

31 POUNDS OF STEEL IN 6¾ MINUTES!

This job looked really tough. Machining from the solid meant unusually heavy metal removal . . . and our customer had to hold some pretty close tolerances and turn out parts *fast*! Here's what did the trick! Our new P&J Automatics have the extra power it takes to hog out metal fast *and* the extra rigidity that's needed to stay within the required limits under the heaviest feeds. You can see how teaming a machine like this with P&J Tooling, to save even more time by combining cuts, made it possible to complete one of these spools every 11 minutes. A new P&J Automatic can bring performance like this into your plant too. Send me your sample prints, and I'll show you how a P&J Automatic with P&J Tooling can help you turn out your toughest jobs faster, better and at lower cost. Write to Potter & Johnston Company, Pawtucket, Rhode Island.

HERE ARE THE FACTS:

PART: *Chuck Operating Spool.*
MATERIAL: *Cut-Off Bar Stock #34 Carbon Steel.*
REQUIRED: *Machine from the solid. Ten separate precision cuts.*
RESULTS: *A part completed every 11 minutes in a single, fully automatic cycle, removing a total of 40 pounds of metal.*
MACHINE: *P & J Model 6DRE-40.*



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . GILDA PACKAGING MACHINES

POTTER & JOHNSTON
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.
PRECISION PRODUCTION TOOLING SINCE 1898

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BENDERS, Plate, Etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., Roselle, N. J.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., Roselle, N. J.

BENDING ROLLS

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Pangborn Corp., Hagerstown, Md.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT

Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BLUEPRINT MACHINERY & ACCESSORIES

Wickes Brothers, 512 No. Water St., Saginaw, Mich.

BOLTS, NUTS AND SCREWS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukana, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr. Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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"SEEING IS BELIEVING"
let this film show you how

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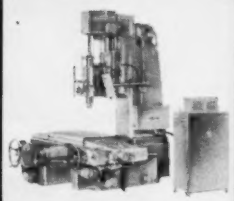
Electrolimit
JIG BORER



- INCREASES ACCURACY
- HELPS ELIMINATE COSTLY ERRORS
- IMPROVES WORK QUALITY

And
- REDUCES PRODUCTION COSTS IN THE TOOLROOM *AND ON THE PRODUCTION LINE!*

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for a showing of the new 16 mm sound motion picture film in full color.
"ACCENT ON ACCURACY"

Write on your company letterhead to Pratt & Whitney Company, Inc., 12 Charter Oak Blvd., West Hartford 1, Conn.

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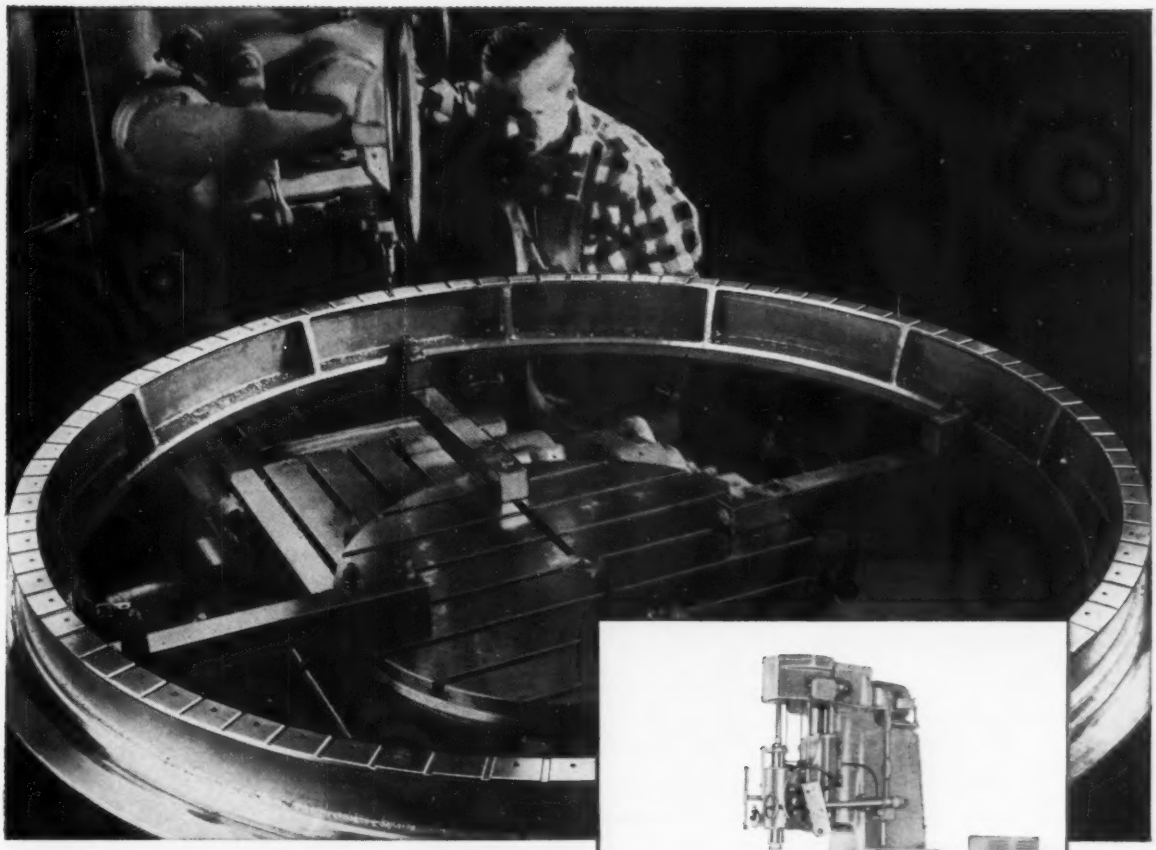
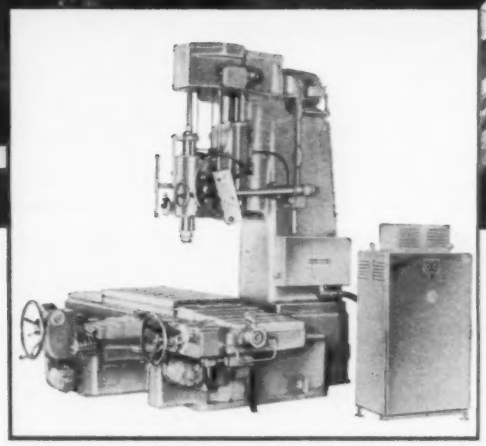
FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES
CUTTING TOOLS





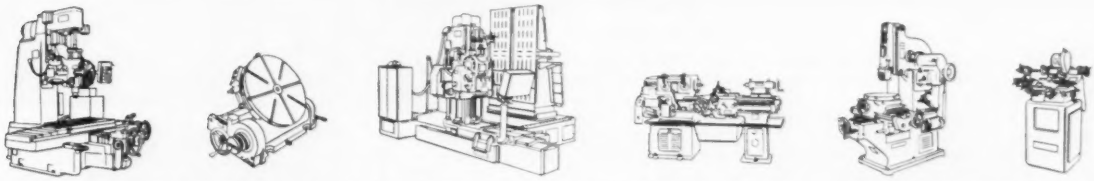
PRECISION plus BIG CAPACITY

P&W JIG BORERS WITH OPEN-SIDE CONSTRUCTION

Nearly 6 feet in diameter, the aircraft tooling fixture shown above was really big! It required machining 84 slots and boring 84 holes on the face and machining 84 slots on the flange. *All* 252 slots and holes had to be equally spaced and located within ± .001" of true radial. Handling jobs like this with ease and efficiency takes the combination of high precision and big work capacity you'll find only in a Pratt & Whitney Jig Borer with Open-Side Construction.

Pratt & Whitney Jig Borers – both Electrolimit and End-Measure types – are produced in complete lines for every work size requirement. All types and models will locate accurate to .0001" . . . and will retain this initial high precision and rigidity *indefinitely!* Get complete information now.

Write for your copy of Circular No. 587. Pratt & Whitney Company, Incorporated, 12 Charter Oak Boulevard, West Hartford 1, Connecticut.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

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BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., 285 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park, Annex Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Vascolay-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., Roselle, N. J.

BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig

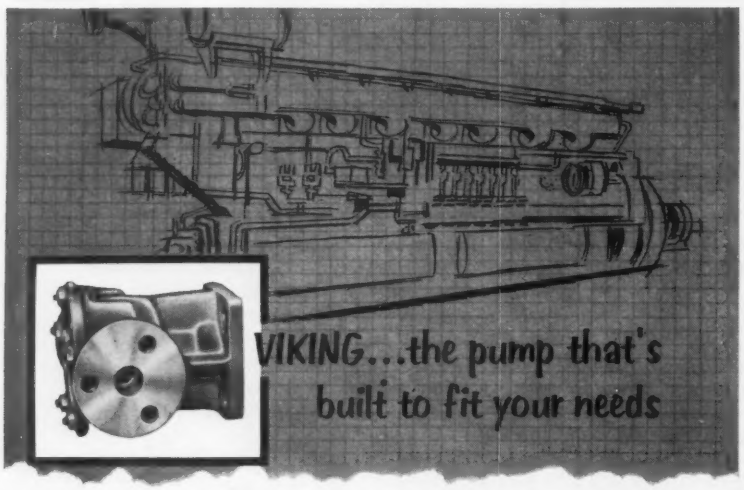
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal

American Crucible Products Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.



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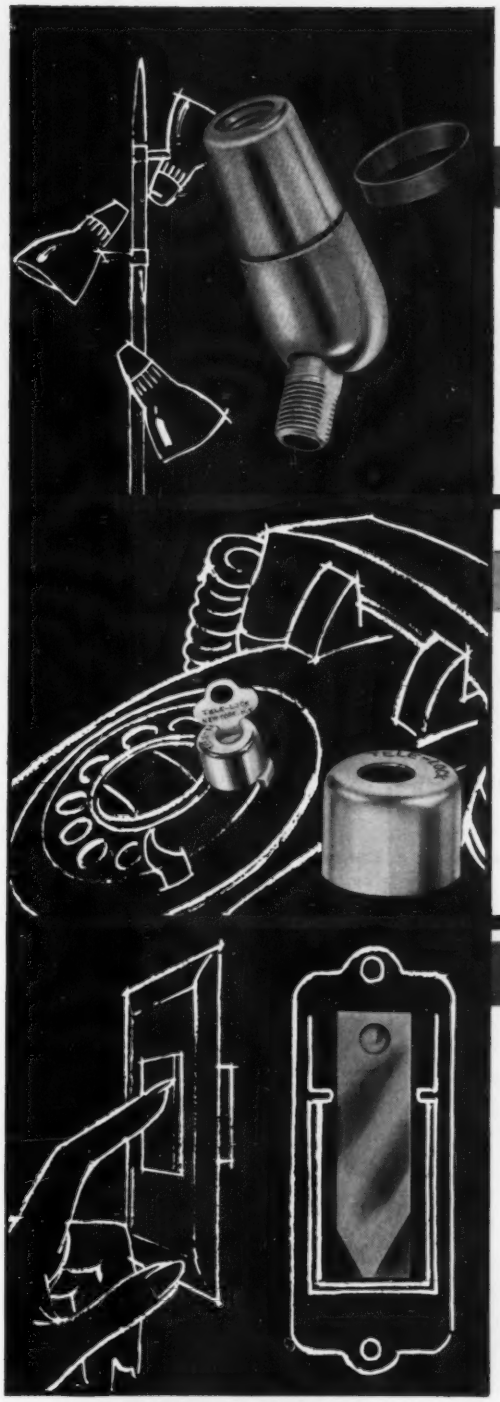
In Canada, it's "ROTO-KING" pumps
THE ORIGINAL "GEAR-WITHIN-A-GEAR" ROTARY PUMP
See our Catalog in Sweet's Product Design File



How three manufacturers use Anaconda superfine-grain alloys

DURAFLEX® makes swivel lamps swivel better

Berger Machine Products of Maspeth, New York, manufacturers of lighting-fixture parts, had a problem with a swivel fixture. To allow adjustment of the reflector, the two steel parts (illustrated) have to rotate 350 degrees. Steel-on-steel froze and locked. A brass ring bushing helped, but being soft allowed the steel to cut in and bind. Berger tried Duraflex, Anaconda's superfine-grain phosphor bronze, and found the answer. Its springiness, hardness and wear-resistance made a snug fit which turned easily and would hold in any position.

FORMBRITE® helps finish phone locks faster

Tele-Lock, an ingenious device for locking a dial phone, is encased in a chromium-plated brass cup. Slaymaker Lock Co., Lancaster, Pa., was using ordinary drawing brass for this cup and found finishing costs high. They turned to Formbrite, Anaconda's superfine-grain forming brass. The cups were easy to form; the slight extra spring and hardness made the fit perfect. The smooth surface of Formbrite eliminated one polishing operation and provided an ideal surface for a lasting chromium plate.

DURAFLEX makes superior contacts for Touch-Plate®

Touch-Plate Mfg. Corp., Long Beach, Calif., makes low-voltage switch systems for control of lighting in the home. It takes only a flick of the finger or elbow on the momentary contact switches to actuate a relay, or set of relays, which turns lights on or off in one room or through the house. For the contact strips in Touch-Plate wall switches they now use Duraflex, Anaconda's superfine-grain phosphor bronze, because they found it has more spring, better recovery properties. Duraflex is now used also for contacts in the relays which operate the Touch-Plate system.

FOR INFORMATION WRITE: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5767

DURAFLEX

The new superfine-grain phosphor bronze with greater endurance limit.

FORMBRITE

The new superfine-grain drawing brass that cuts finishing costs.

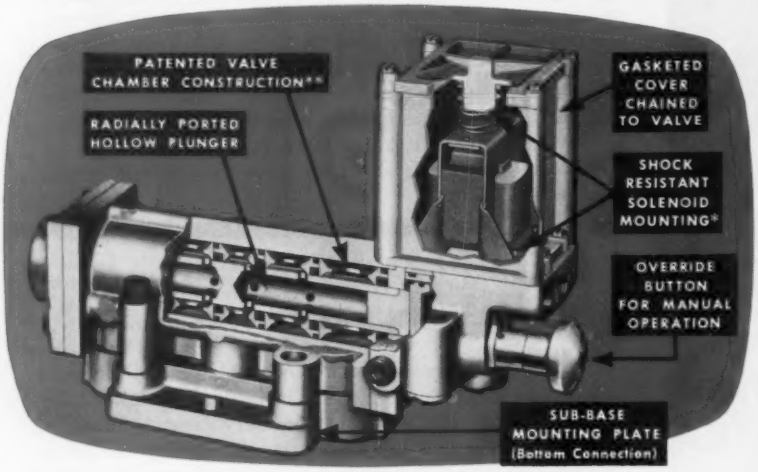
ANACONDA®

PRODUCTS

MADE BY THE AMERICAN BRASS COMPANY

Quick-As-Wink®

JIC ½" TYPE BJ SOLENOID VALVES


PATENTED VALVE CHAMBER CONSTRUCTION**
RADIALLY PORTED HOLLOW PLUNGER
GASKETED COVER CHAINED TO VALVE
SHOCK RESISTANT SOLENOID MOUNTING*
OVERRIDE BUTTON FOR MANUAL OPERATION
SUB-BASE MOUNTING PLATE (Bottom Connection)

offer users many outstanding advantages

Painstakingly designed, ruggedly built and tested for more than 4 years, these new JIC Quick-As-Wink valves combine: —

1) **HIGH FLOW CAPACITY.** The valves have full ½" pipe capacity.

2) **SHOCK RESISTANT SOLENOID MOUNTING*.** Positioning the solenoid with a spring on resilient rubber rings reduces destructive hammering and pounding, greatly increasing solenoid life.

3) **DIE CAST ALUMINUM COVERS** are fully gasketed, mounted with captive screws, and fastened to the valve with a chain.

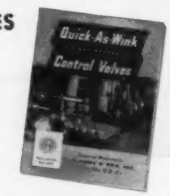
4) **SUB-BASE MOUNTING PLATE.** Available in two designs so that pipe connections can be made through the bottom or through the side.

5) **PATENTED VALVE CHAMBERS** are formed by aluminum spacers in accurate metal to metal end abutment** that hold the "O" rings and "U" packers in exact position, and supported on both inside and outside diameters, without mechanical pressure. This proven construction permits repacking easily, quickly and accurately in the field.

6) **OVERRIDE BUTTON** permits manual operation in case of power failure.

MANY OTHER OUTSTANDING FEATURES

Also available in 2 position and 3 position Double Solenoid;—2 position and 3 position Lever Operated;—and Single and Double Pilot Operated Designs.



Get full details about this new valve.
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*Patent Applied For **U. S. Patent 2,645,450

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

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CABINETS, Tool
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPERS, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

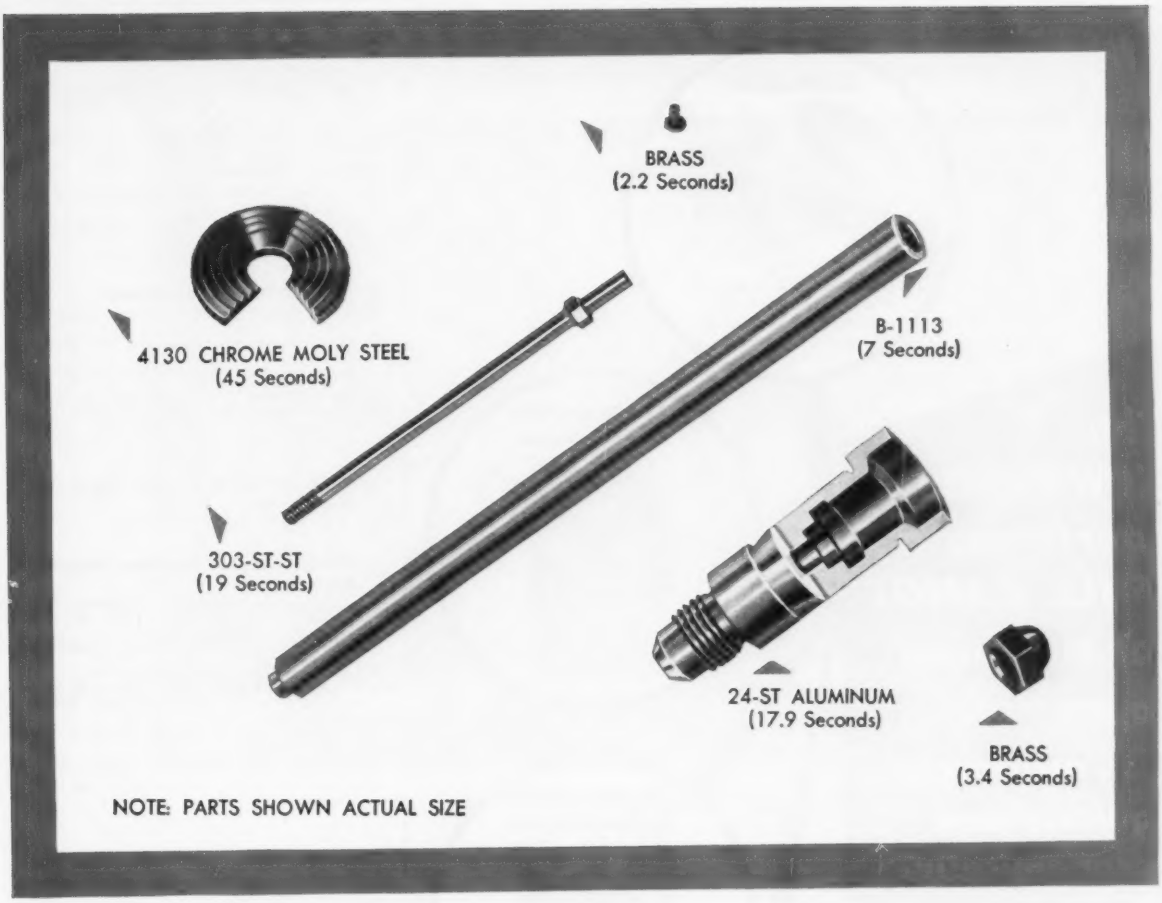
CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd. Ferndale, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
American Crucible Products Co., Lorain, Ohio.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Denver, Ohio.
Dow Chemical Co., Midland, Mich.
Mueller Brass Co., Port Huron 35, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS, Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio.
Challenge Mchry. Co., Grand Haven, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.



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Machines for **CUTTING** ferrous and non ferrous materials in regular or irregular shapes up to 20" dia.

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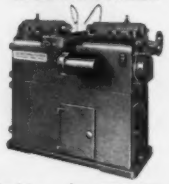
Machine Division



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Standard and Special Machines for drilling and **TAPPING** incorporating rotary index tables.

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Hopper Fed Secondary Operation Machines for **TURNING**, drilling, pointing, grooving of headed blanks.

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Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

CEMENT, Abrasive Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTER-DRILLING MACHINES
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
La Salle Tool Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Brown & Sharpe Mfg. Co., Providence, R. I.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

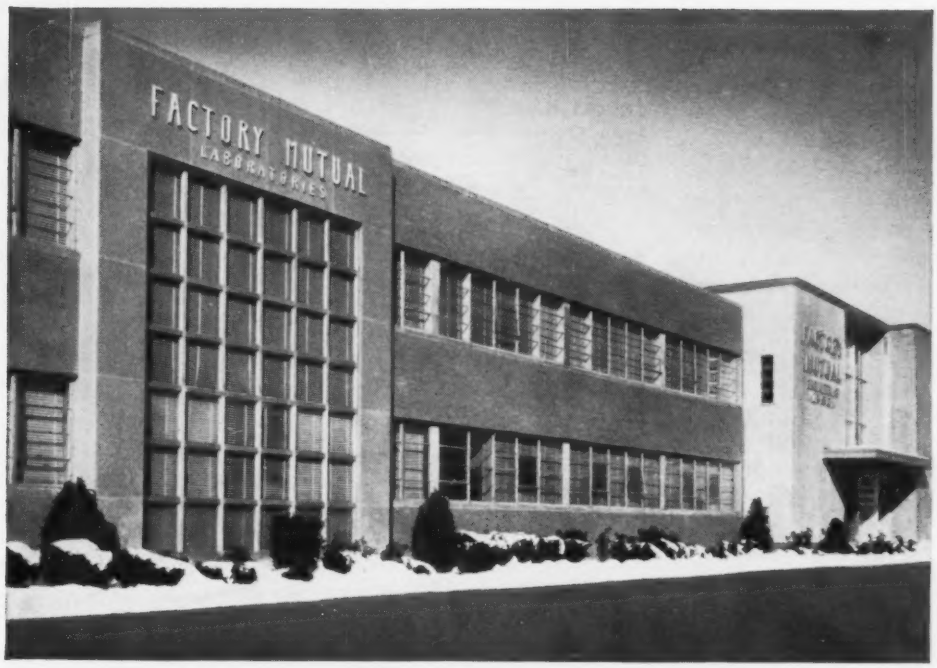
CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

(Continued on page 312)



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the low-cost, fire-resistant hydraulic fluid

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*Trademark

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SHELL

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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet

Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Wadell Equip. Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Burg Tool Mfg. Co. Inc., Gardena, Calif.
Jacobs Mfg. Co., West Hartford 10, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit Wis.

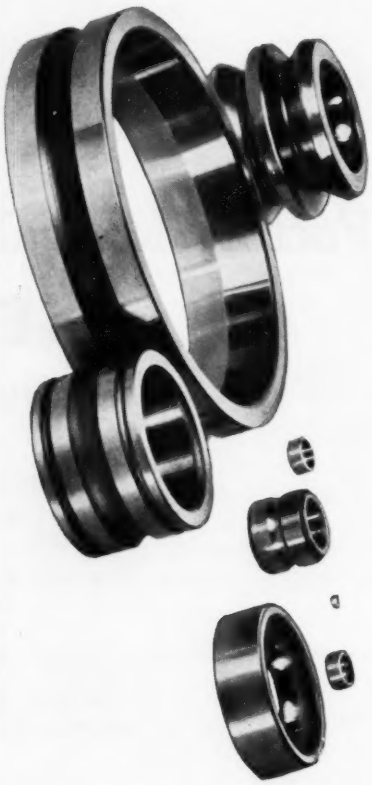
CHUCKS, Tapping

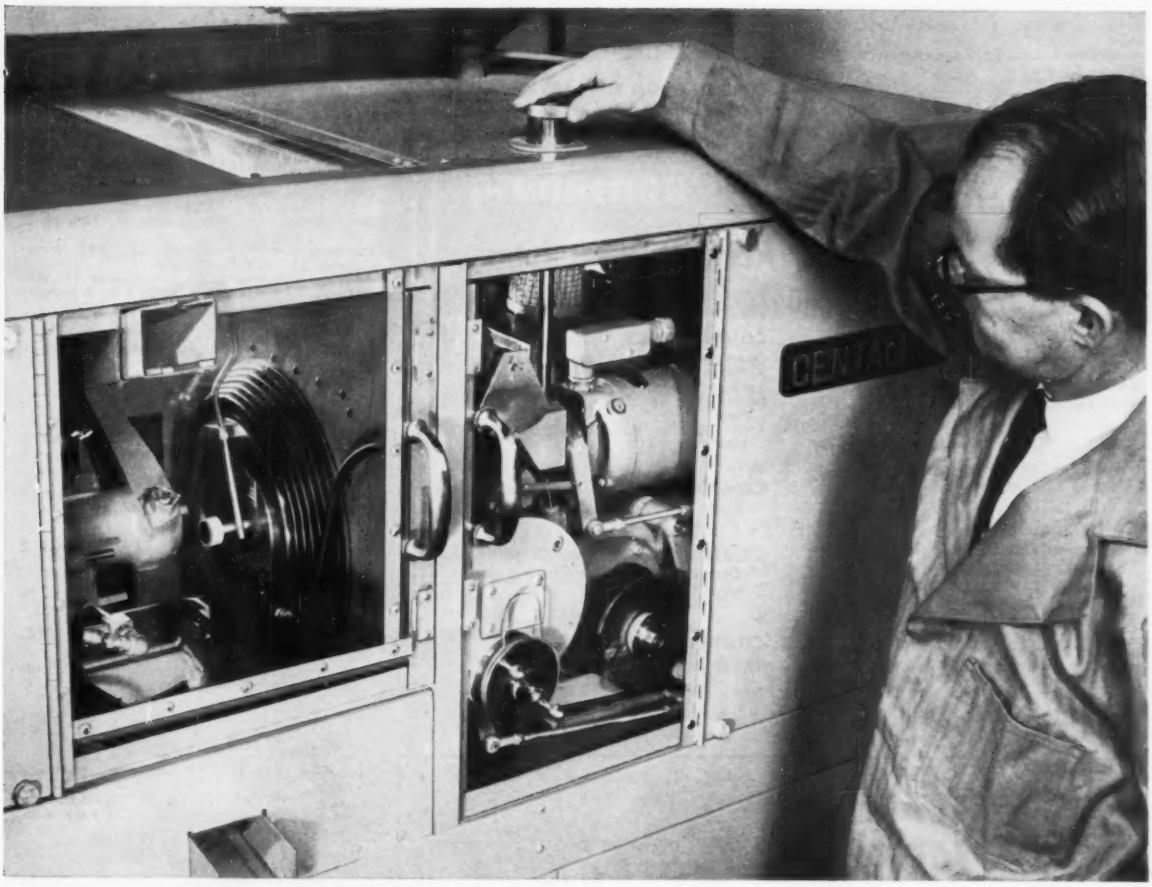
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

(Continued on page 314)

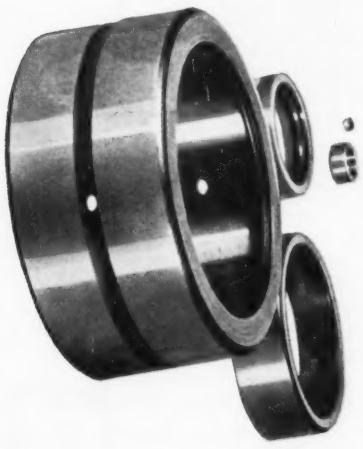
Meet J. K. AIKEN

... one of Bryant's experts on internal grinding of all types. "Ken", who has been with Bryant for 27 years, covers the New England territory.





Fastest Precision Internal Grinder Ever Built!



The Bryant "Centalign" proves, over and over again, that you can cut internal grinding time up to 50%.

The "Centalign" is a *production-proven* internal grinding machine, capable of grinding straight bores, tapers and raceways in precision bearings with incredible speed and constant accuracy.

The "Centalign", by means of its completely new construction principles, dramatically outperforms any and all other comparable equipment on the market. The production gains and cost savings it has given bearing manufacturers throughout the world are so substantial, that no bearing manufacturer can afford *not* to investigate.

Ask for an immediate demonstration!

BRYANT Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

For more information fill in page number on Inquiry Card, on page 229

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Universal Three-Jaw
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment Spacing Equipment

CLEANERS, Metal
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Fawick Corp., Cleveland, Ohio
Minster Mch. Co., Minster, Ohio.
Rockford Clutch Div., Rockford, Ill.
Twin Disc Cultch Co., 1361 Racine St., Racine, Wis.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Sheffield Corp., Box 893, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers, Inc, 1000 Post St., Toledo 10, Ohio.
Bliss, E. C., Co., 1375 Raff Rd., S. D., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co, Watertown, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Heller Tool Co., Newcomerstown, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co. 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

COUNTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G Sts., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Twin Disc Clutch Co., Racine, Wis.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

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HIGH SPEED BAND SAWS

IS EXCEEDINGLY FAST, SMOOTH, INVOLVES SO LITTLE DOWN-DRAG THAT FORMED PARTS CAN READILY BE CUT WITHOUT ANY REST.

Tremendous time and cost savings, in cutting sheet steel, formed or flat, trimming malleable and steel castings and similar operations, are available to you with these machines.

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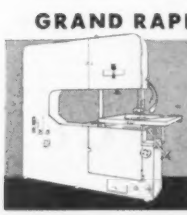
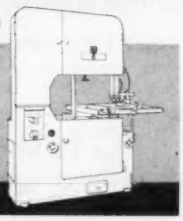
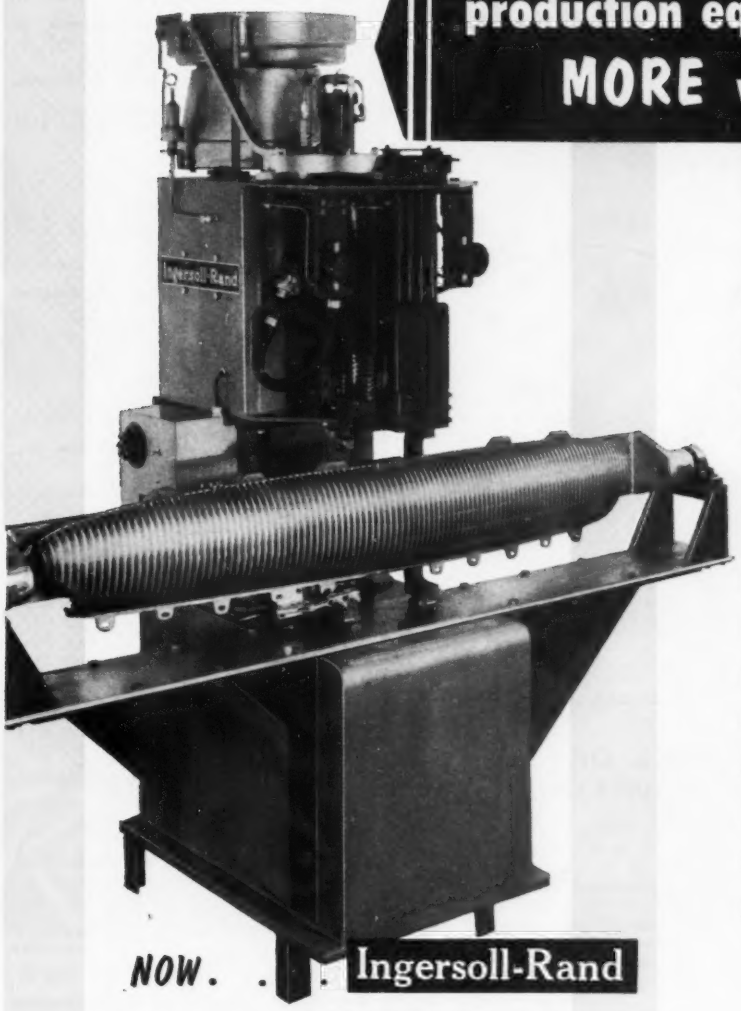


TANNEWITZ DIE-SAWS
24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Die Saws on the market. Write for bulletin.



SAWING MACHINERY SPECIALISTS

production equipment produces MORE with PEECO



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includes DEVELOPED PEECO FEEDERS

The Ingersoll-Rand Model FSD4A1 (illustrated) feeds and drives eight self-tapping hex head screws for automobile radiator grille assembly. Completed cycle for this quality controlled, time saving operation is accomplished in less than one-half of the time formerly required.

IN THE field of vibratory parts feeders, PEECO'S leadership stands unchallenged. Manufacturers of production equipment for various markets are finding that PEECO'S engineering knowledge in small parts feeding is helping them increase the capacities of new production equipment. One of the many companies in the production field now being served by PEECO is the established name of Ingersoll-Rand.

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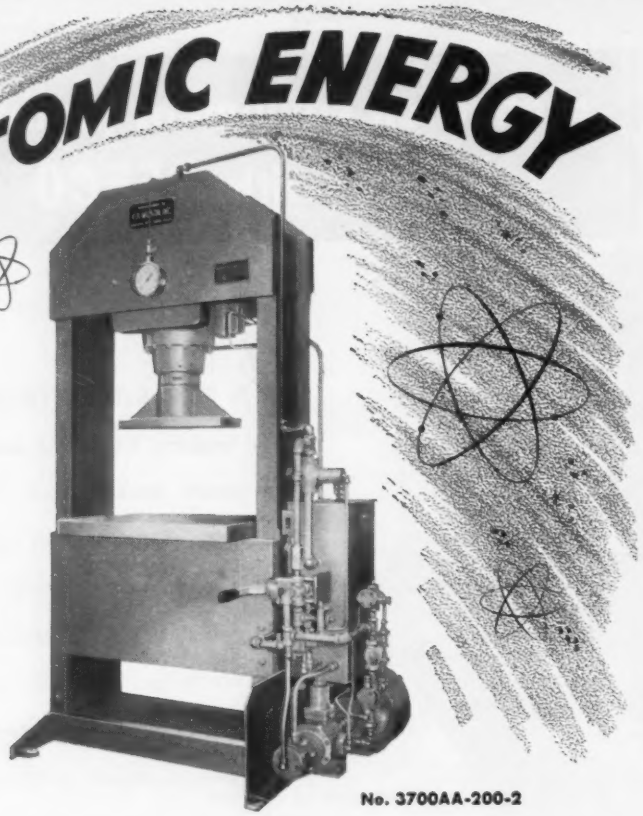
EXCLUSIVE MANUFACTURER
OF VIBRATORY PARTS FEEDERS

Peeco PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. • • • DIVISION OF AUTOMATION DEVICES, INC.

K. R. WILSON PRESS HELPS HARNESS ATOMIC ENERGY



No. 3700AA-200-2

DRAMATIC EXAMPLE OF PRESS PROGRESS BY WILSON

Zirconium! . . . in this single word lies a story of remarkable press progress at K. R. Wilson. A press was needed for cutting and pressing zirconium, glistening metal vitally important in the construction of nuclear reactors for atomic energy. The problem was put to Wilson engineers. *The challenge was accepted and a press was built to do the job!* The K. R. Wilson 3700AA-200-2 200-Ton Capacity Motor Driven Hydraulic Press combines all the features necessary to cut and press zirconium with maximum efficiency and economy. The 3700AA-200-2 is but one of scores of examples of the years-ahead technical thinking that makes any type of Wilson press your wisest buy.

CONSIDER THE FEATURES AND YOU'LL CHOOSE WILSON
MODEL No. 3700AA-200-2

HEAVY DUTY RAM 6" diameter heat treated and ground alloy steel ram. 10" bore. 18" stroke.

DOUBLE ACTING CYLINDER Provides power on upstroke for stripping and to offset weight of tooling.

COMPLETE RAM CONTROL Stops in any position; allows you to raise just enough to clear work.

GUIDED RAM Non-rotating ram completely eliminates ram turning.

SIDE-MOUNTED HYDRAULIC UNIT Requires minimum amount of floor space; easily accessible for service.

RAM SPEEDS Rapid Idle Approach Speed to 23 tons, 52" per minute. Pressing Speed to 200 Tons, 8¾" per minute. Rapid Idle Return to 15 Tons, 75" per minute.

FOR FULL DETAILS WRITE FOR BULLETIN No. 37

HYDRAULICS DIVISION
K. R. WILSON, Inc.
OFFICES AND FACTORIES — 212 MAIN ST., ARCADE, NEW YORK, U.S.A.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio

CUTTERS, Keyseating
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Goddard & Goddard Co., Detroit, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS
Cincinnati Milling Products Div., Cincinnati, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

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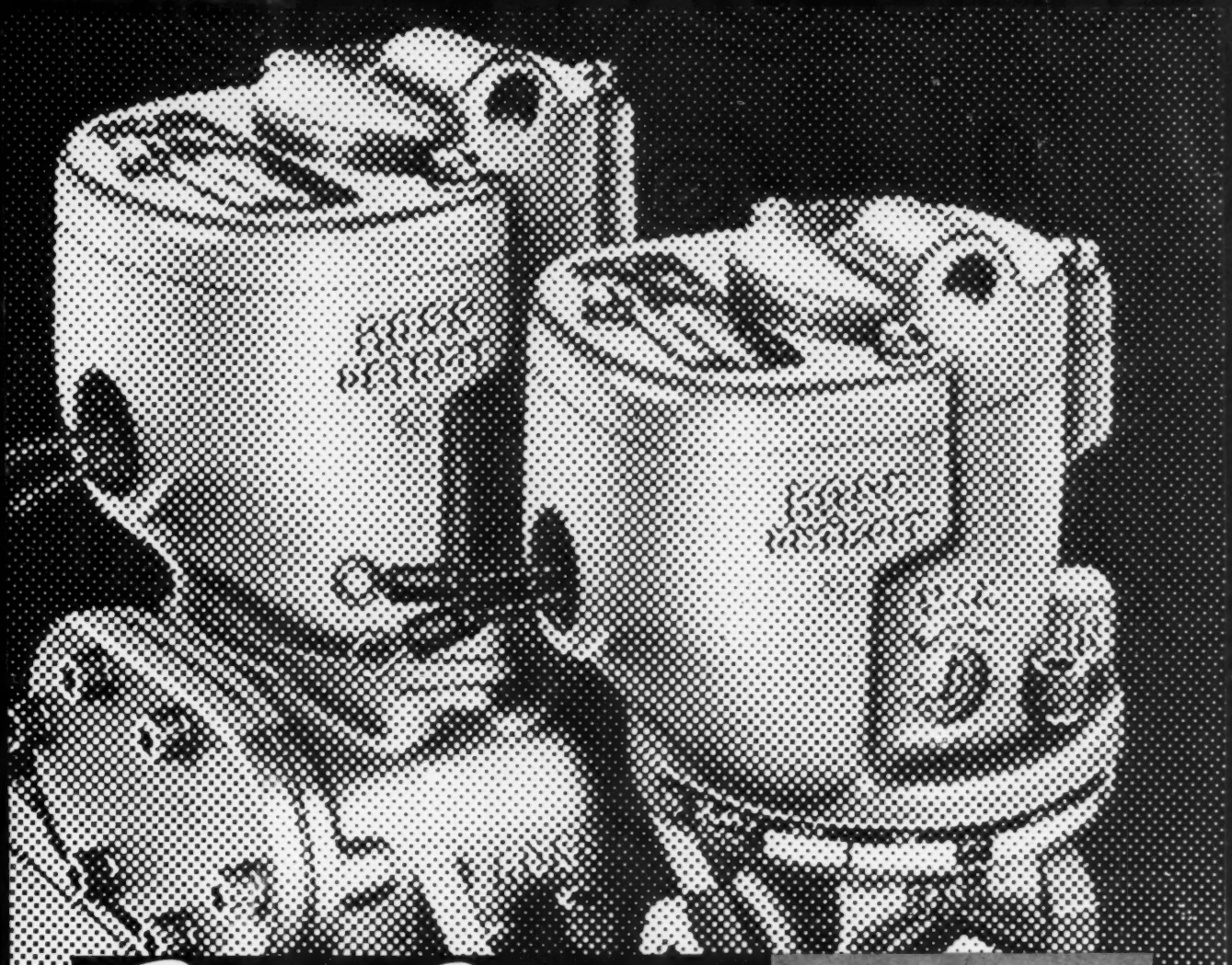
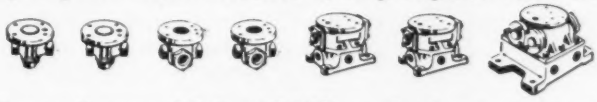


Ross Skyline

Silvermodel JIC Spool Solenoid

Any Skyline Head Attaches to Any Skyline Valve Body



Interchangeable! 25 Million Cycles in Tests!

Now the JIC spool solenoid valves join the Ross Skyline. Now six actuating heads and seven in-line and base mounted bodies—all completely interchangeable—give you any valve you want in this series designed especially to last millions more cycles than ordinary valves. But, these quality valves come to you at *sensible* prices! For instance, the ⅜" Silvermodel base mounted, 4-way is only $62.50 complete, and complies with all JIC requirements. Write for bulletin 315.

Ross OPERATING VALVE COMPANY

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STRETCH ROLLS THAT STRETCH DOLLARS... for manufacturers of paper-making machinery. They're centrifugally cast by Shenango to provide complete uniformity, pressure-dense grain, freedom from blow holes, sand inclusions and other hidden defects. They'll wear longer, take abnormal stresses, loads and speeds without the risk of costly failure. If you need virtually any symmetrical part, ferrous or non-ferrous, large or small, rough or finished, write to: Centrifugally Cast Products Division, The Shenango Furnace Company, Dover, Ohio.

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MONEL METAL • NI-RESIST • MEEHANITE METAL • ALLOY IRONS

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St. Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIEING MACHINES

Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., Akron, N. Y.

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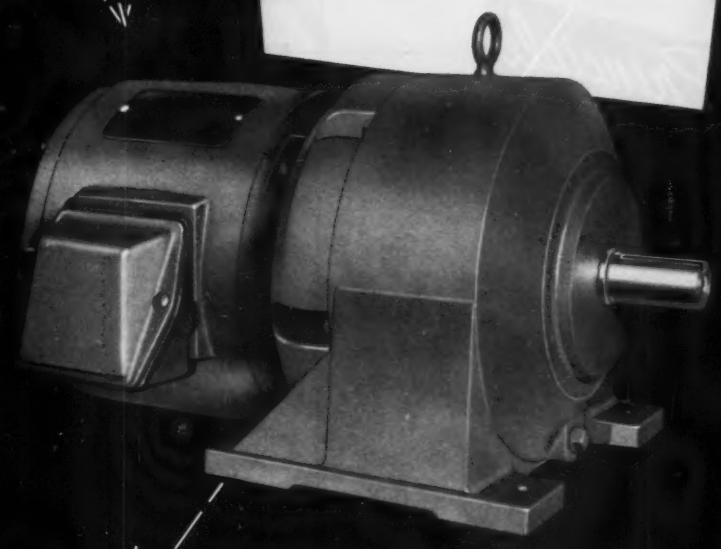
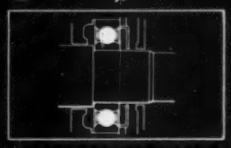
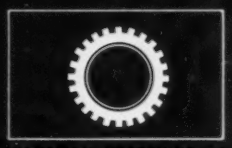
Don't overlook what you can't see



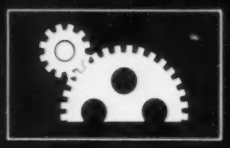
You can't always see what makes a gearmotor outstanding. It's the attention paid to small design details that makes the difference. Here are a few of the details that make the new Reliance Gearmotor stand above the rest.



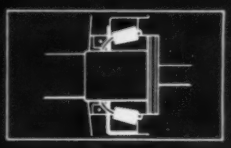
FOOLPROOF METERMATIC motor bearing lubrication and oil bath gear lubrication for long-life protection against wear.



INDUCTION HARDENING of the tough alloy steel gears gives a perfect combination of wear resistance and strength.



SIMPLIFIED GEARING with few moving parts reduces friction losses and lessens chances of breakdown.



THRUST BEARINGS handle heavy overhung loads safely by placing strain on the frame instead of the shafts.

Find out the complete story for yourself— contact your Reliance representative or write for Bulletin E-2408.

E-1509

REDUCE SPEED

RELIANCE ELECTRIC AND ENGINEERING CO.

CLEVELAND 10, OHIO · OFFICES IN PRINCIPAL CITIES

Canadian Division: Welland, Ontario

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DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing

Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Eastern Mch. Screw Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

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Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

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Electro-Spark Co., Inc., 23 E. 26th St., New York 10, N. Y.
Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

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DoAll Co., Des Plaines, Ill.
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Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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(Continued on page 322)

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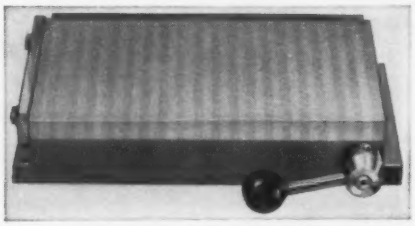

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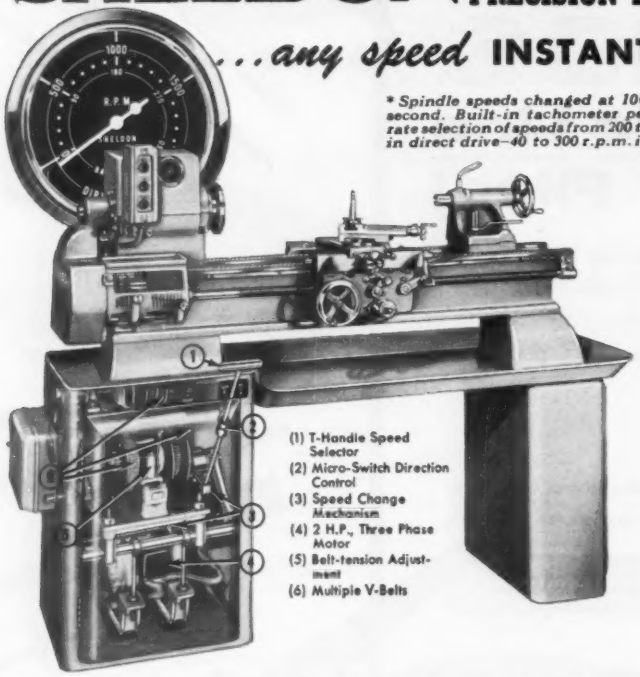
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(4) 2 H.P., Three Phase Motor
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This new lathe instantly meets every changing speed requirement in the tool room, or quickly sets and holds to any prescribed speed for production runs.

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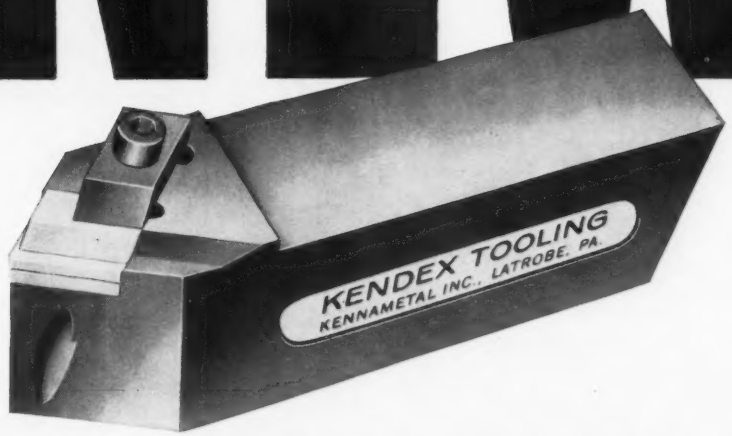
(Continued on page 324)

NEW



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The first "throw-away" insert profiling tool for both roughing and finishing cuts

Here is a new Kennametal Tool, designed specifically for today's contouring machines . . . a profiling tool that incorporates the time-saving, cost-reducing, production-boosting "throw-away" insert feature . . . the first profiling tool with an insert that won't shift . . . *the first profiling tool that can be used for roughing and intermediate cuts, as well as finishing.*

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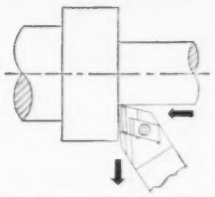

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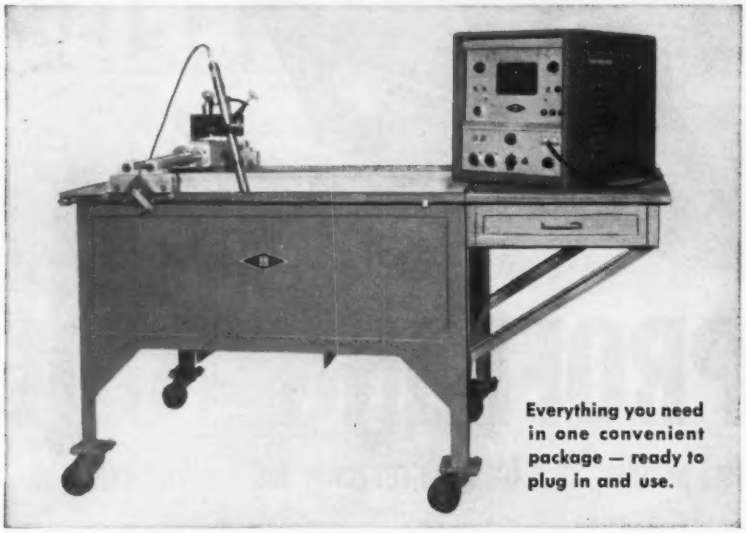

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Tough, hard ceramic coatings provide superior bearing surfaces

Sprayed alumina forms "sapphire-hard" surfaces highly resistant to wear, abrasion and corrosion. Ideal for bearing surfaces, seals.

Development of the new METCO THERMOSPRAY GUN for spraying high-melting-point ceramic materials at low cost opens up a variety of new practical applications. One that has produced a great deal of interest is the use of sprayed alumina coatings for bearing surfaces and mechanical seals. This THERMOSPRAY 101 Ceramic Powder produces surfaces with a hardness of 9.0 on the Moh scale, (only the diamond rates 10.0) with excellent resistance to wear, abrasion and corrosion. When used in combination with special phenolic or furane plastic sealers it provides superior protection against many acids.

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Hard-facing alloys of the self-fluxing, nickel-boron-silicon type in powder form can also be applied with the METCO Type P THERMOSPRAY GUN. These coatings may be fused, semi-fused, or left unfused depending on the hardness desired, from RC 30 to RC 65, depending on the alloy and the process used.

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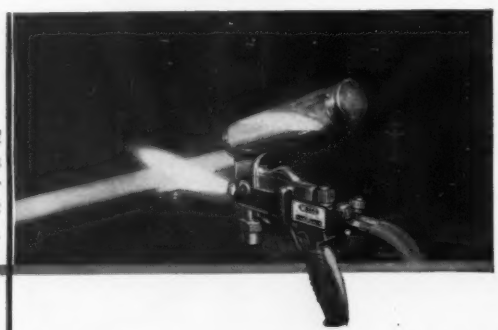
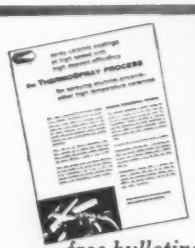
Preliminary engineering data contained in Bulletin 127 covers ceramic coatings while Bulletin 126 covers the hard-facing alloys. Either or both may be obtained by filling out the coupon below or writing on your company's letterhead. No obligation, of course.



Pump rod sprayed with alumina provides superior protection against abrasion and corrosion.



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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., Akron, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Oil Hole, Oil Tube

Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

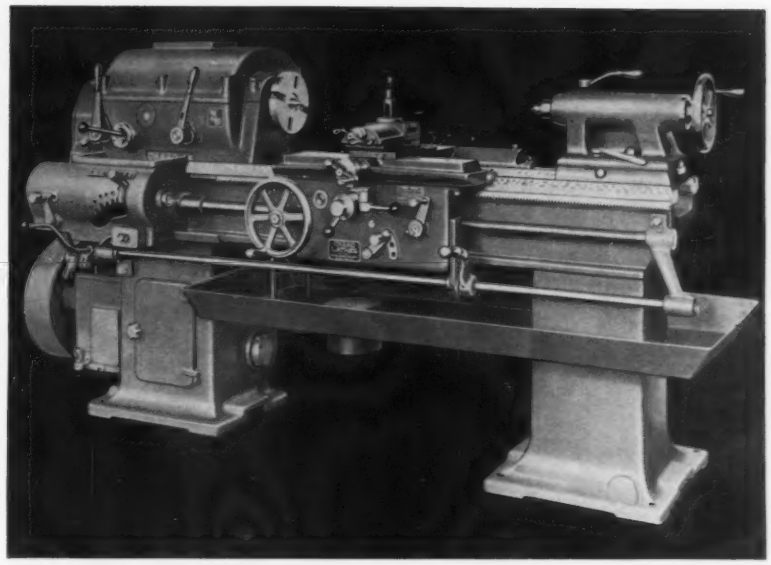
DRILLS, Portable Electric

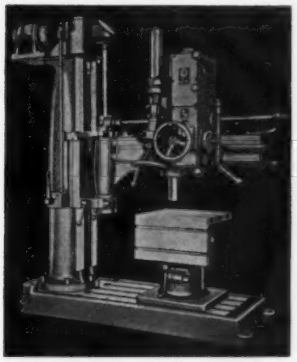
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

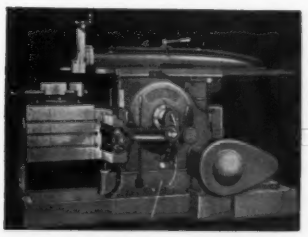
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

CHARD Multi-Speed Quick Change Engine Lathe Precision Timken Bearing Equipped—Made 16", 18" and 20" Sizes—8 or 12 Speeds—Twin Disc Clutch.

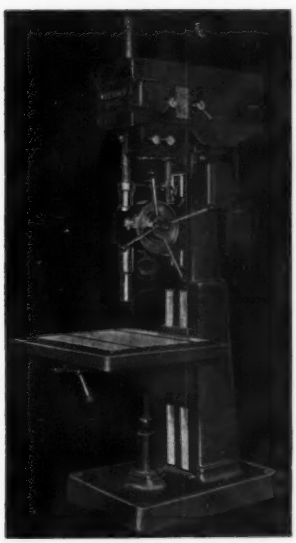




WESTERN RADIAL DRILLS —Heavy Duty, 3 to 8 ft., 16 or 32 speeds. High Speed, 3 to 6 ft., 6, 9, 12 or 18 speeds.



STEPTOE SHAPERS — 14" to 24" Heavy Duty; 12" and 15" High Speed, up to 200 strokes per minute.



WESTERN UPRIGHT DRILLS —Single or multiple spindle; 18 speeds; 9 feeds; all geared; up to 2½" capacity.

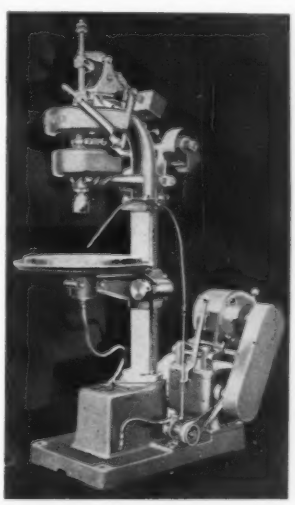
THE BIG 4 WESTERN LINE

"RELIABLE—SINCE 1895"

The gearbox of the CHARD MULTI-SPEED LATHE contains exclusive features which contribute to the superiority of performance in marked degree over other lathes. It is located at the head-end cabinet leg and contains four of the changes of speed, the start-stop clutch mechanism, spindle brake, and silent chain sprocket for driving direct to the spindle in the headstock above. Segregating most of the high speed gearing close to the floor line and away from the main spindle serves to isolate vibration, reduce stresses in the headstock casting and add to the general stability of the machine. Single or double back-geared headstocks are available. The spindle is mounted on four Timken tapered precision roller bearings. All speed control is from the headstock position. Complete line of optional equipment.

For more information on these and other machines in the Big 4 line write for catalogs. Specify sizes required.

GARVIN AUTOMATIC TAPPERS—Up to 3" pipe tap capacity; four spindle speeds.



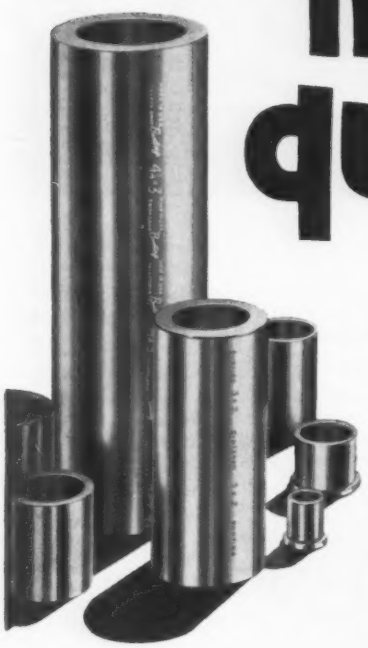
MANUFACTURED BY

WESTERN MACHINE TOOL WORKS
HOLLAND, MICHIGAN, U.S.A.

For more information fill in page number on Inquiry Card, on page 229

YOU GET more* WHEN
YOU BUY BEARINGS FROM
YOUR Bunting® DISTRIBUTOR

* more quality



PRECISION, QUALITY AND COMPLETE FINISHING make possible the simplest and most economical application of Bunting Bearings. Bunting Cast Bronze Bearings and Bars and Bunting Sintered Powdered Oil-filled Bearings and Bars give you components that save time and expense in both production and maintenance operations. Bunting distribution of these stock products through leading, responsible distributors in all areas brings Bunting quality right to your door.

Your Bunting distributor is listed in the classified section of your telephone directory usually under Bars—Bronze, and Bearings—Bronze. Two modern Bunting factories and eleven Bunting Branch Warehouses expedite distribution in all areas. Write, or ask for catalogs giving complete dimensional listings and technical data.

Simplified standardized size listing including all ASTM sizes—an exclusive Bunting feature.

Bunting | BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL.

The Bunting Brass and Bronze Company • Toledo 1, Ohio • Branches in Principal Cities

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp. Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped

Ace Drill Corp., Adrian, Mich.
Allegheny Ludlium Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

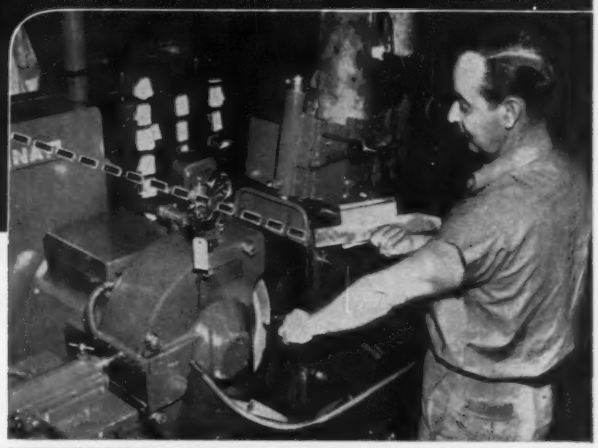
Ace Drill Corp., Adrian, Michigan
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATING ATTACHMENTS — See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

Talide-Tipped Blades on the job for over 10 Years!



SPS

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNSYLVANIA

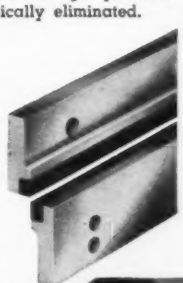
world's largest producer of socket screws, has been a regular user of Talide-tipped centerless grinder blades for the past 10 years. SPS centerless grinders are equipped with super-hard Talide centerless blades, enabling millions of precision parts to be centerless ground without downtime for blade changing, regrinds or replacements. The Talide carbide wear strip is produced by us in ONE SOLID SECTION UP TO 100" IN LENGTH WITHOUT SEAMS. A solid carbide wear strip has been proven more efficient than shorter sections brazed or butted together because the possibility of marking or scoring the work is eliminated.

TALIDE ROTARY KNIVES GIVE PHENOMENAL RUN OF 90-1...

A leading strip steel producer of razor blade, high-carbon, spring and stainless steel reports over 1200 coils were gang slitted with Talide knives compared to 15 coils with steel knives. More tonnage was produced in one regrind of the Talide knives than over the entire life of a set of steel knives. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

$18,000 SAVED USING TALIDE SHEAR BLADES!

A large electric motor manufacturer shearing .014" silicon steel for transformers advises first year savings of $18,000 in blade costs after completely equipping their press line with Talide-tipped blades in lengths ranging from 15" to 87". Talide shear blades are averaging 1,000,000 cuts per grind compared to 10,000 cuts obtained with steel blades.



Over 50 sizes and styles of standard blades carried in stock—with special blades made promptly to order. Write for 76-page catalog 56-G or ask for sales engineer to call.

METAL CARBIDES CORPORATION
Youngstown 12, Ohio

EXCLUSIVE RETIPPING SERVICE

Because of its exclusive hot press method, Metal Carbides is able to rework worn, chipped out or broken areas of carbide-tipped blades back to original size and dimension with all breaks and defects eliminated.

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

For more information fill in page number on Inquiry Card, on page 229

ELECTRICAL DISCHARGE MACHINES
—See Disintegrators

ELECTROPLATING EQUIPMENT
Wagner Brothers, Inc., 433 Midland Ave., Detroit 3, Mich.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine Wis.
Urban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

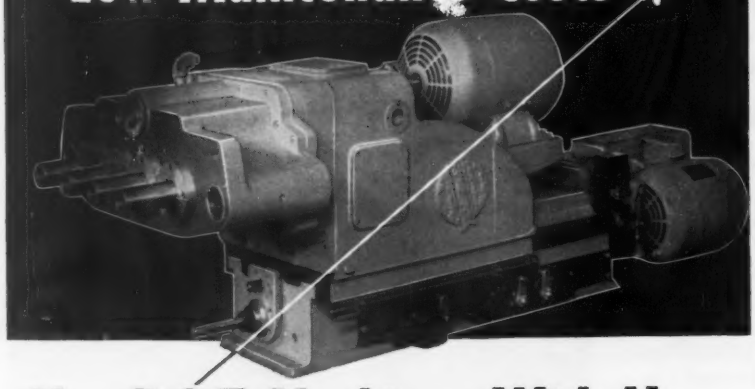
EXPANDERS, Mechanical, Hydraulic
Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw
Chicago-Latrobe Twist Drill Wks., 411 W Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Walton Co., Hartford 10, Conn.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

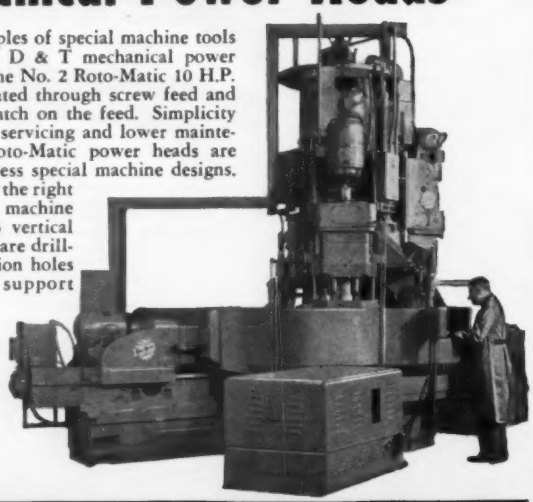
FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

For High Production and Low Maintenance Costs *



Use D&T Machines With New Mechanical Power Heads

Here are two good examples of special machine tools designed and built with D & T mechanical power heads. Shown above, is the No. 2 Roto-Matic 10 H.P. head. All sizes are operated through screw feed and have overload release clutch on the feed. Simplicity of design makes for less servicing and lower maintenance costs. D & T Roto-Matic power heads are readily adapted to countless special machine designs. For instance: Machine to the right is a 6 station indexing machine with 3 horizontal and 3 vertical power heads. Operations are drilling and reaming suspension holes and king pin holes in support arms for power heads.



Free Data is available on the complete line of D & T machines. Ask for Bulletin 1000.

DAVIS and THOMPSON Roto-Matic

Davis & Thompson Company
6411 W. BURNHAM ST., MILWAUKEE 14, WISCONSIN

FEEDERS, Automatic
Perry Equipment & Eng. Co., Erie, Penna.
Production Feeder Corp., Mentor, Ohio
V & O Press Co., Hudson, New York

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Severance Tool Ind., Inc., Saginaw, Mich.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Ind.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill

FINISHES, Machine and Metal
Lowe Bros. Co., Dayton, Ohio

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.

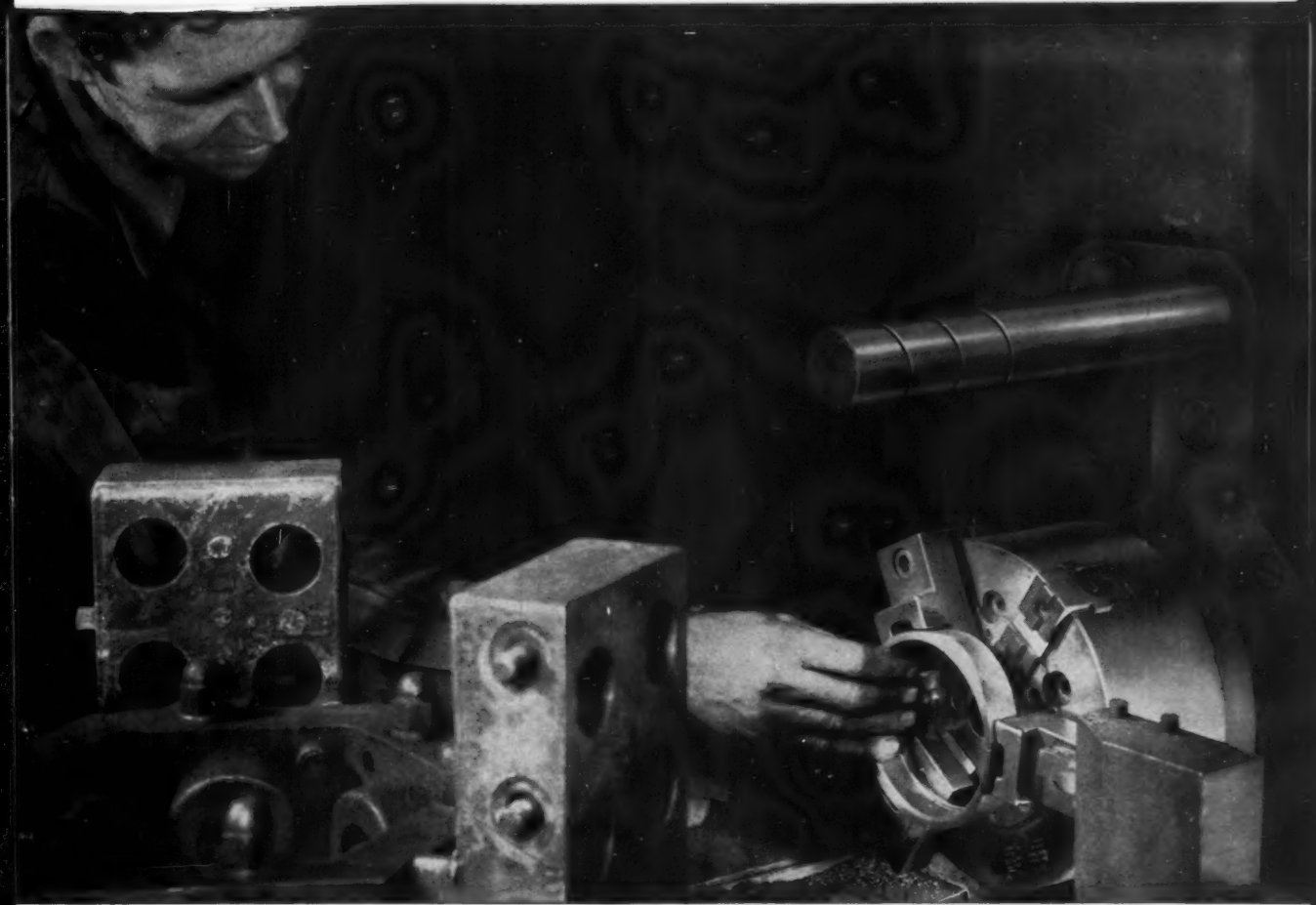
FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Machinery Co., Tiffin, Ohio

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.

(Continued on page 332)

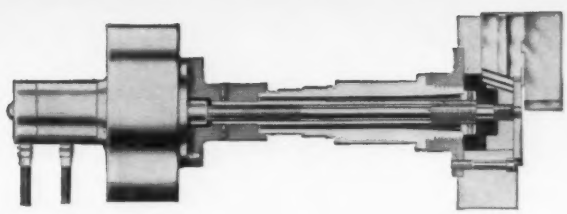


Skinner Power Chucks will chalk up immediate savings on your production machines!

Cost-per-piece savings add up to a really important figure for production boring done on this Skinner-equipped Potter & Johnston 3-U Speed-flex automatic chucker. You can give your plant the same kind of savings, too.

Look at that Skinner Power Chuck. It grips and releases instantly — compressed air does the hard work, and does it fast. You can see how much longer it would take to chuck these pieces by hand — time that pushes up costs. Elimination of hand wrenching cuts fatigue way down, too — operators like that.

You'll put your plant in a much better profit position when you equip your production machines with Skinner Power Chucks, because you'll greatly reduce your most important cost factor: overall machining time. Write for Catalog 68P, with complete specifications, applications, and installation instructions. Write Dept. 156.

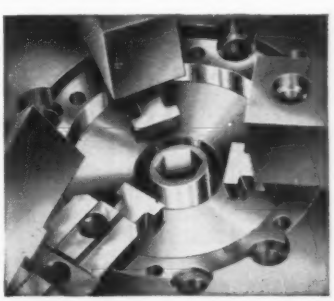


For small lathes, too!

On small lathes, like South Bend, Hardinge, Sheldon, Logan, or Atlas, used on production runs, the Skinner "Junior" Power Chucking Unit will cut costs by saving *time*. Ask for special Bulletin JP67.

Simple, dependable operation.

Skinner's proved-in-service wedge principle guarantees positive, trouble-free operation. Jaws are closed or opened instantly by an actuating wedge, operated by a double-acting air cylinder.



Skinner Power Chucks are available through leading Industrial Distributors everywhere.

SKINNER CHUCKS

THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING MACHINES, Cold-rolling

Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Grinding

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness

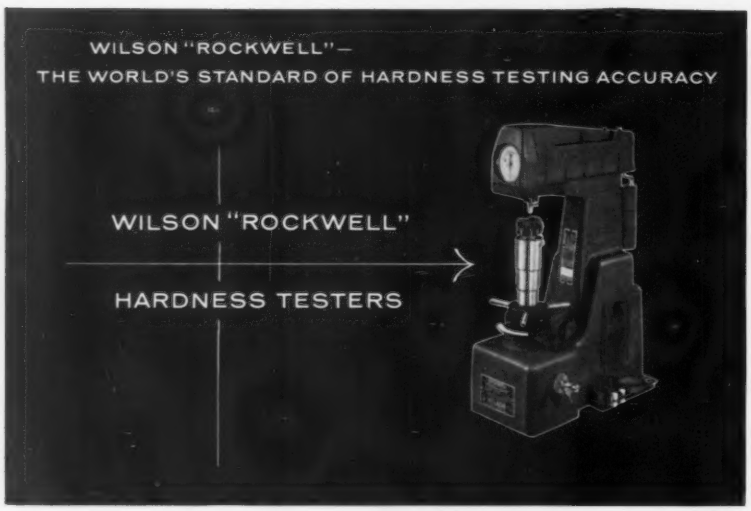
Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., Des Plaines, Ill.



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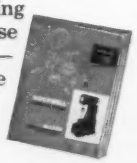

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Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

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DoAll Co., Des Plaines, Ill.
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Starrett Co., L. S., Athol, Mass.

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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel and Spiral

Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GEAR MOTORS—See Speed Reducers

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Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
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Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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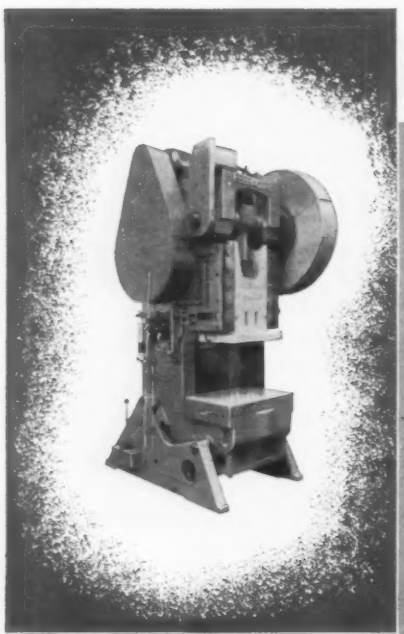
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut
Automotive Gear Works, Inc., South 8th & O St., Richmond, Ind.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.



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GRADUATING MACHINES
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

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Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
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GRINDERS, Carbide Tool
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
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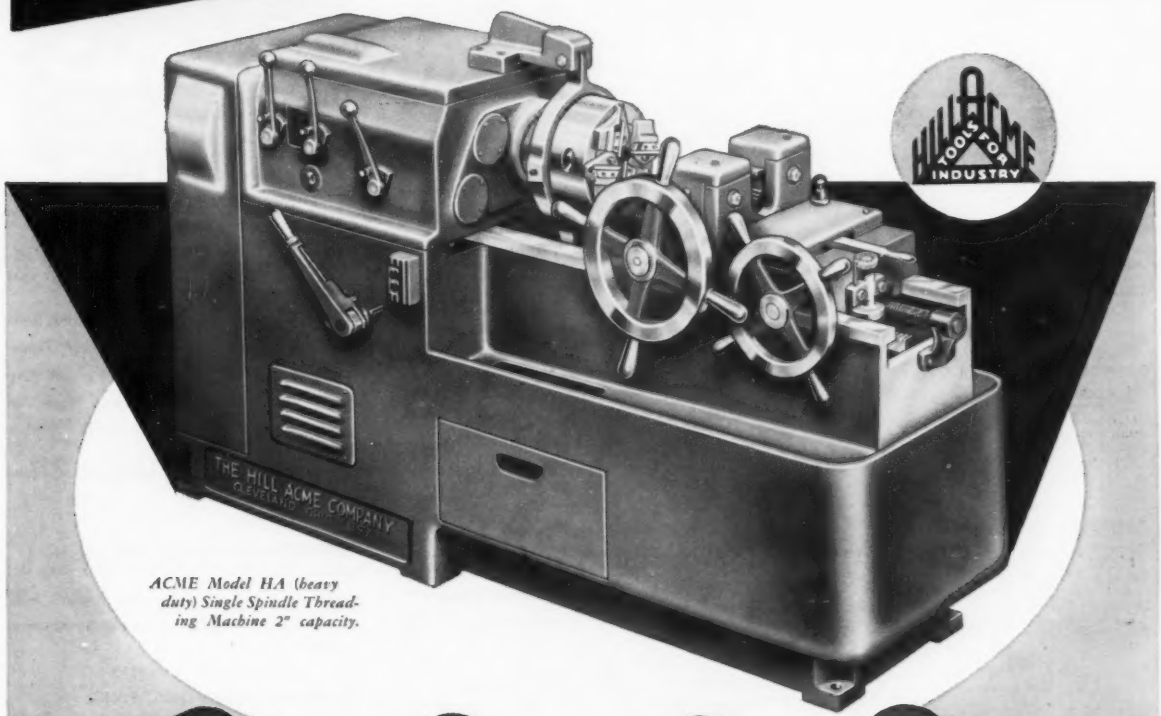
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

GRINDERS, Toolpost
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River

The Newest ACME Model HA THREADING MACHINE



ACME Model HA (heavy duty) Single Spindle Threading Machine 2" capacity.

New Design

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New Built-in Precision

New Versatility

Wide Speed Range: The Acme Model HA has eight spindle speeds assuring correct speeds for various diameters and materials to be threaded.

Adjustable Carriage: Adjustable both horizontally and vertically to permit alignment with the die head.

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The Acme Model HA is adaptable to either tangential or hob type die heads using tangential or hob type chasers of standard design. Model HA Threaders are built in 1", 1½", 2" and 2½" capacities in single or double spindle design.

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GRINDERS, Die and Mold
Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill
Kearney & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River, Cincinnati 4, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Rockford Die & Tool Wks., Inc., Rockford, Ill.

GRINDERS, Tool and Cutter
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

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Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

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Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Crankshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Cylindrical
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Van Norman Mch. Co., Springfield, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Jones & Lamson Mch. Co., Springfield, Vt.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll
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GRINDING MACHINES, Surface Reciprocating
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand, Inc., Larchmont, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

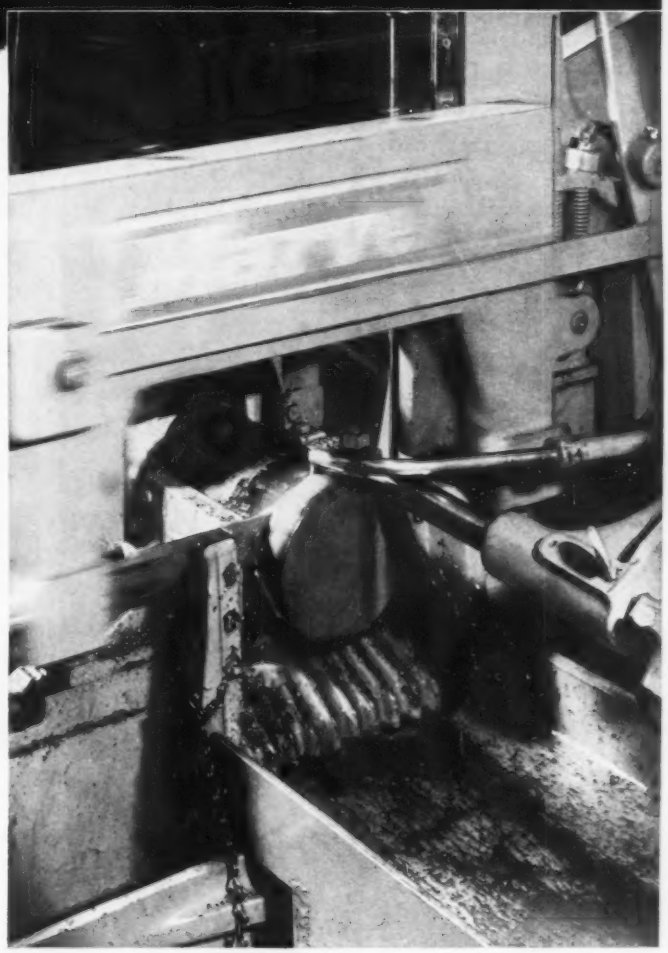
GRINDING MACHINES, Surface Rotary
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.

(Continued on page 338)

5 Basic Reasons why MARVEL HACK SAWS CUT-OFF MORE ACCURATELY...

The consistently accurate performance of MARVEL Heavy Duty Hack Saws is no accident. MARVEL engineers knew, many years ago, that to produce and maintain accurate cutting-off, a hack saw must be designed and built like a fine machine tool.

Some of the basic design principles built into the modern MARVEL Hack Sawing System that makes it the most accurate cutting-off method you can use are:



1. V-Way Design...Greater Rigidity

Upright and Saddle are precision machined and fitted to form a rigid, integral unit capable of withstanding any cutting load with no deflection or side movement.

2. Anti-Friction Bearing Construction

Anti-friction ball or roller bearings are used at all load carrying points. Even the strongly braced saw frame reciprocates on heavy duty, fully enclosed preloaded ball bearings which provide permanent, frictionless rigidity and true-running, straight line cutting strokes.

3. Minimum Blade Frame Reach

Close-coupled design and crank lever action of MARVEL Saws keeps the saw frame and blade reach very short in relation to the vertical V-ways on which the unit is mounted. This insures optimum rigidity, even under the most severe operating conditions.

4. Positive Relief Blade Lift

On the return stroke, positive relief lift raises the blade to provide proper and "cushioned" lead-in on the next cutting stroke. This prolongs blade sharpness, life and accuracy.

5. Rigid Cutting Tool

Cutting-off accuracy requires a rigidly held, relatively short cutting tool. MARVEL Unbreakable High-Speed-Edge Hack Saw Blades, which combine a narrow high speed steel cutting edge permanently welded to a tough alloy steel body, can be tensioned from 200% to 300% more taut than ordinary blades. This provides a most rigid cutting edge.

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Better Machines-Better Blades

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Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

GRINDING WHEEL DRESSING AND FORMING DEVICES

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Niagara Falls, N. Y.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6 Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.

GROOVING TOOLS, Internal

Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa
Edlund Mchry. Co. Div., Cortland, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

HARDENING FURNACES

General Electric Co., Schenectady, N. Y.

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEAT-TREATING EQUIPMENT—See Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Goddard & Goddard Co., Detroit, Mich.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son A. 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY Tools and equipment

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch., 3640 Main St., Springfield 7, Mass.
Wadell Equip. Co., Clark, N. J.
Western Machine Tool Works, Holland, Mich.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
duMont Corp., 289 Wells St., Greenfield, Mass.
Starrett, L. S., Co., Athol, Mass.

(Continued on page 341)

. . . Fluid Power news

REPORT NO. 11,500 PACKAGED POWER FOR PRESSES

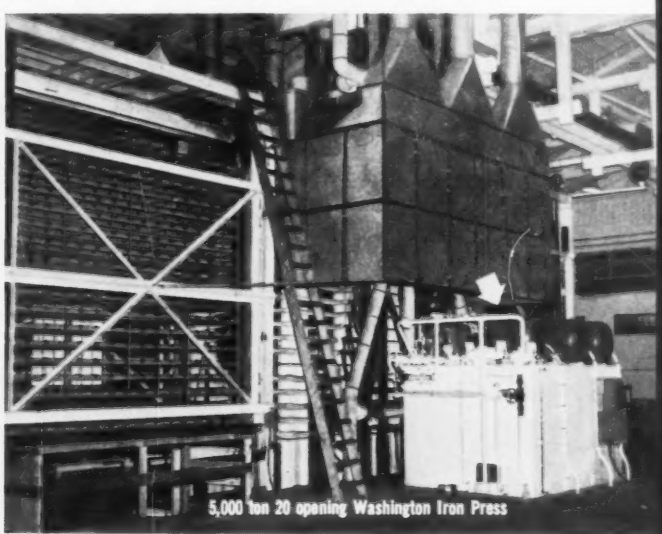
From Oilgear Application-Engineering Files

HOW OILGEAR SYSTEMS BOOST QUALITY PRODUCTION—CUT OPERATING COSTS

CUSTOMERS: *Many Modern Hot Plate Press Builders and Users (Names Withheld)*

DATA: For presses with capacities ranging from 500 to 5,000 tons, or two-press operation. It is desirable to have one company responsible for the entire power system, rather than an assembly of components of different origin. Should have remote, preset, accurate, automatic push button control of multiple time cycles, pressures, and ram speeds to improve quality—increase production. "Presets" to be simply, rapidly adjusted by user personnel. High speed platen approach and return needed to increase productive cycles per hour. Remote location of equipment to prevent absorption of heat from the press . . . with a minimum of piping to keep maintenance and installation costs to a minimum. Systems must be leak-tight, trouble-free, dependable, capable of virtually continuous operation.

20 opening Columbia Press



5,000 ton 20 opening Washington Iron Press

SOLUTION: Shown are three typical installations where Oilgear "Power-Paks" have been application-engineered by Oilgear—with the press manufacturers—to achieve the modern concept of high speed automatic production of hardboards and plywood. These are complete Oilgear Fluid Power systems that include pumps, motors, reservoir, valves, and controls custom-built into a single "Power-Pak." Oilgear "Power-Paks" offer many advantages other than a mere unitized assembly . . . automatic conservation of electrical power . . . precision-controlled, variable cycle times and board pressures—with a complete choice of controls ranging from manual to completely automatic, remote push button . . . high-speed platen approach and return . . . leak-tight welded fittings and pipe joints . . . completely pressure and flood lubricated by the oil in the system—assuring long, trouble-free, dependable life. Oilgear's complete "Power-Paks" eliminate costly hand-fitted assemblies, unnecessary engineering, excessive power loss, leaks, repetitive malfunctioning, "Christmas tree" appearance. Press manufacturers and users alike report . . .

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For practical solutions to YOUR *linear or rotary drive and control problems, call the factory-trained Oilgear application-engineer in your vicinity. Or write, stating your specific requirements, directly to . . .*

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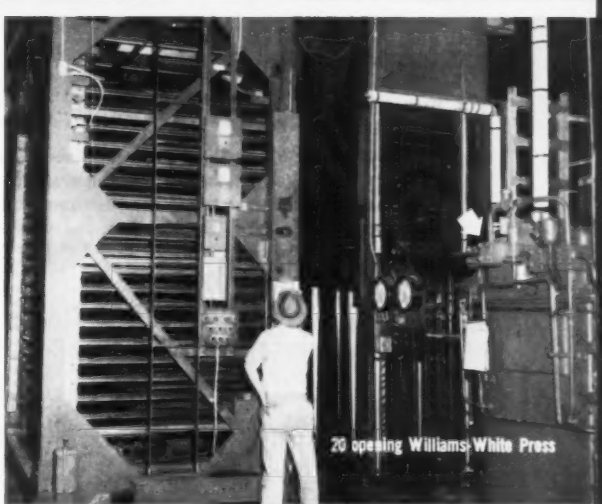

20 opening Williams-White Press

Oilgear application-engineered Fluid Power systems are not limited to linear drives for hot plate or pulp baling presses. They are highly successful on rotary drive applications as veneer clippers, sawmill carriages, feed rolls, resaws, gang saws, edgers, trimmers, log handling equipment, transfer systems, winders and calenders. For controlled, linear or rotary power—check with Oilgear!

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Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

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General Electric Co., Schenectady, N. Y.
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INSPECTION EQUIPMENT, Ultrasonic

Curtiss-Wright Corp., Caldwell, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Roselle, N. J.

JACKS, Planer—See Set-up Equipment

JIG BORERS

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
M. B. I. Export & Import, Ltd., 475 Grand Concourse, New York 51, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Illinois
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350 Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., Div. of American Gage & Mch. Co., 2500 W. Washington Blvd., Chicago 12, Ill.

LATHE ATTACHMENTS

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Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

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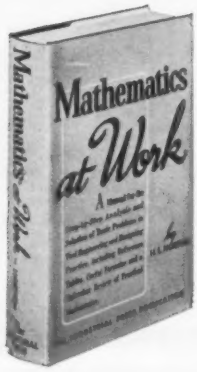

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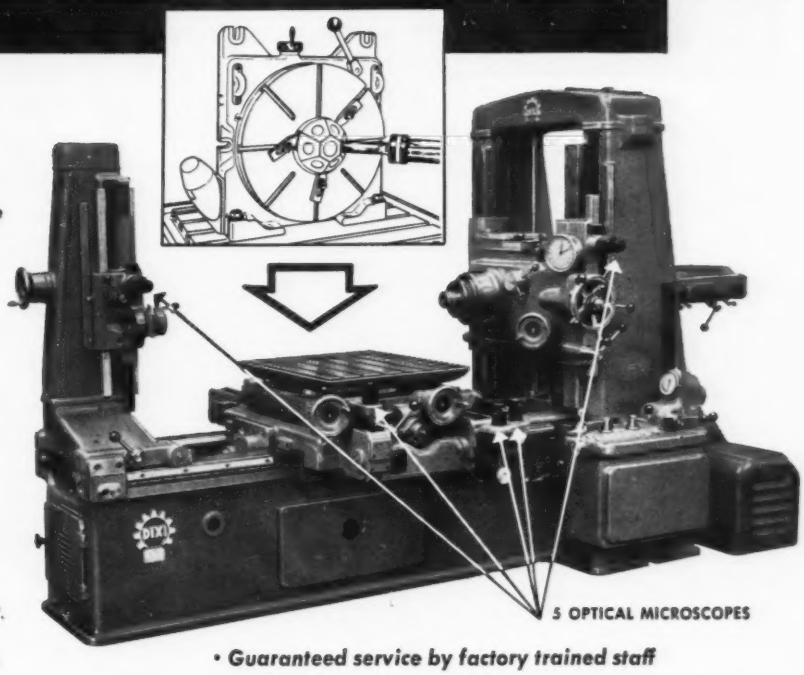

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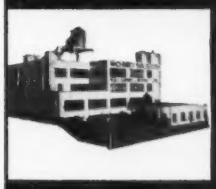

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WHEN THE BOTTOM DROPPED OUT of the ERIE CANAL

Of the many noteworthy events that took place back in 1907, one of the most unusual occurred near Syracuse New York, where a part of the bottom of the Erie Canal dropped out. Four canal boats were sucked through and shattered; a flour mill was badly damaged; and there was a loss of over $500,000. This catastrophe may sound more believable when we tell you that the break occurred on a viaduct over Onondaga Creek.

In a more constructive vein, a happier (if less publicized) event occurred in Cincinnati in the same year, when Soren Sorensen and John Christensen founded what was to become The Cincinnati Gear Company.

In the ensuing fifty years, many changes have taken place. People no longer ride on canal boats; and the gear-manufacturing business has progressed similarly. Technologically we've been in the forefront of this progress, but we've also tried to preserve some of the attention to detail and "craftsmanship" that prevailed in those earlier times. The result has been a gratifying record of customer satisfaction — the kind of satisfaction we'd like *you* to experience on your next custom gear order.

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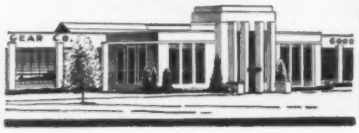

LATHES, Axles

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating

Pilot Div., Cone Automatic Mch. Co., 30 Rockefeller Plaza, New York, N. Y.

LATHES, Crankshaft

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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

LATHES, Engine, Manufacturing

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
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Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Eustacchio, S., Brescia, Italy
Homestrand, Inc., Larchmont, N. Y.
Hydra-Feed Mch. Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Engine, Toolroom

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Gap

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Springfield Mch. Tool Co., Springfield, Ohio

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

(Continued on page 344)

For more information fill in page number on Inquiry Card, on page 229

Introducing...
the Kodak Contour Projector, Model 14-6, with Measuring Table

- **Makes fixturing easier and setups faster with table cross travel of 3″; vertical travel of 2⅛″. Focusing travel is 1½″.**
- **Provides rapid horizontal measurement to the order of .0002″ for toolroom as well as production use. Simplifies gaging of larger parts—less need to reposition.**
- **Slotted worktable—19¼″ x 8″—permits use of standard fixtures for staging wide variety of parts. Throat clearance is 14¼″. Maximum lens height above table, 4¼″; minimum, 2⅛″.**

THE Model 14-6 is equipped with the same high-quality, precision optical system as all other Kodak Contour Projectors. Kodak's famed Ektar Projection Lenses and rigidly built lens mounts and housings insure accurate performance year after year. A full 14-inch viewing screen covers a field of 1.4″ at 10× magnification. Coated lenses which increase light transmission—plus a special Fresnel lens back of the screen—give a bright image, permitting you to use the Model 14-6 anywhere in the plant. Accessory projection lenses provide a choice of six magnifications (10×, 20×, 31¼×, 50×, 62½×, and 100×). All lenses are quickly interchangeable, seat positively for precise rated magnification. Air-cooled lamphouse and simple, handy controls assure operator ease and comfort.

Vertical illuminator, surface illuminator, six-lens turret, rotating screen with protractor ring, and a mobile base are available as accessories. For further information about the new Kodak Contour Projector, Model 14-6, write to:

Apparatus and Optical Division

EASTMAN KODAK COMPANY • Rochester 4, N. Y.

Kodak
TRADE MARK

For more information fill in page number on Inquiry Card, on page 229

Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type
Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls, Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

LEVELS
Lufkin Rule Co., Saginaw, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIGHTS, Indicator
General Electric Co., Schenectady, N. Y.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Van Keuren Co., Watertown 72, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

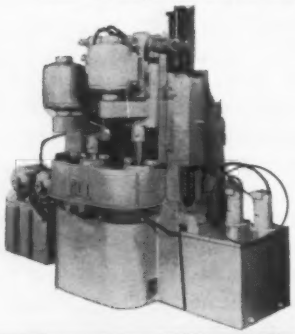
CONNECT THEM . . . FORGET THEM . . .

Ruthman Gusher COOLANT PUMPS

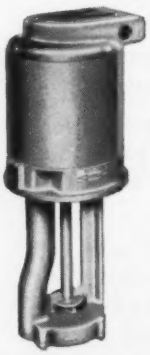
REQUIRE LITTLE MAINTENANCE

Ordinarily Gusher Coolant Pumps require no attention. Because there are no packing glands to adjust and they are equipped with heavy duty prelubricated for life, ball bearings. Your maintenance worries are minimized when you specify Gusher Pumps. **Write for our Catalog.**

THERE'S A GUSHER FOR EVERY REQUIREMENT



Illustrated is a Springfield Dual Spindle Vertical Grinder equipped with Gusher Coolant Pumps.



Model 6-P3 Immersed Type

Ruthman MACHINERY CO.

- COOLANT PUMPS
- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

1807 Reading Rd. Cincinnati, Ohio

For more information fill in page number on Inquiry Card, on page 229

HEAVY DUTY MACHINE TOOLS

Horizontal, vertical lathes, facing lathes and roll lathes.
Roll grinding machines
Planing machines, milling planers
Hydraulic and power presses
Sheet straightening machines
Rolling mills for steel and soft metals
Desiging and manufacture of special heavy duty machines

DOUBLE COLUMN VERTICAL TURNING AND BORING MILL
Turnable diameter 17'

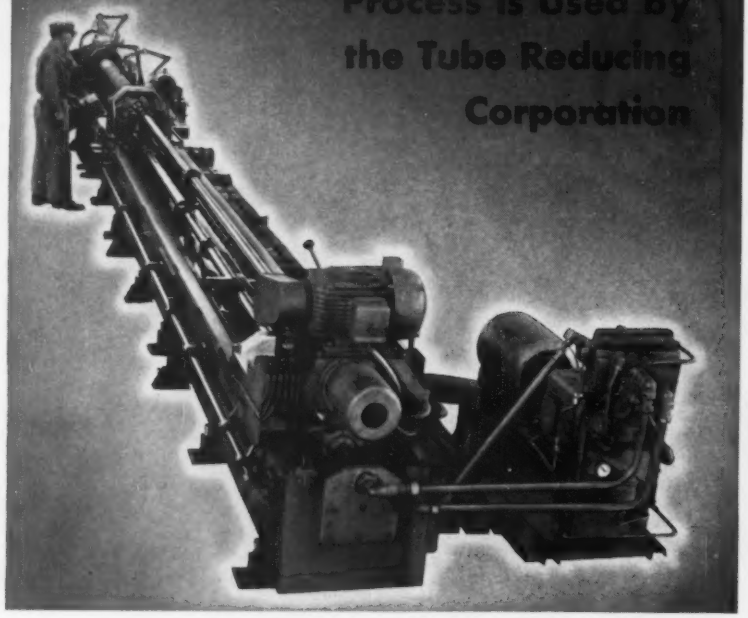
Machining of a yankee roll shell

STABILIMENTI

S. EUSTACCHIO S. p. A.

BRESCIA (Italia)

Why MICROHONING Process is Used by the Tube Reducing Corporation



The carbon steel, stainless steel, alloy steel and non-ferrous tubes manufactured by the Tube Reducing Corporation are used on applications that require high strength, uniform wall thickness and surfaces free of pits, scratches or other imperfections.

In processing its tubes, Tube Reducing uses Microhoning, either to prepare the tubing for its exclusive "Rockrite" process, or to generate functional characteristics in finished tubing.

As a preparatory operation—which produces a round, straight bore and a clean-cut, cross-hatch surface pattern—Microhoning helps to improve the results of "Rockriting." The Microhoned surface slides easily over the "rocking" mandrel and compresses to a smooth, flaw-free surface that passes the most rigid inspection and tests.

Other "Rockrite" tubes, used in such applications as hydraulic cylinders, are Microhoned after "rocking" to generate final bore size and geometric accuracy.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision"... available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____F
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., Yonkers, N. Y.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Morris, Robert E., Co., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Ferndale, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

MILLING MACHINES, Knee Type Ram

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

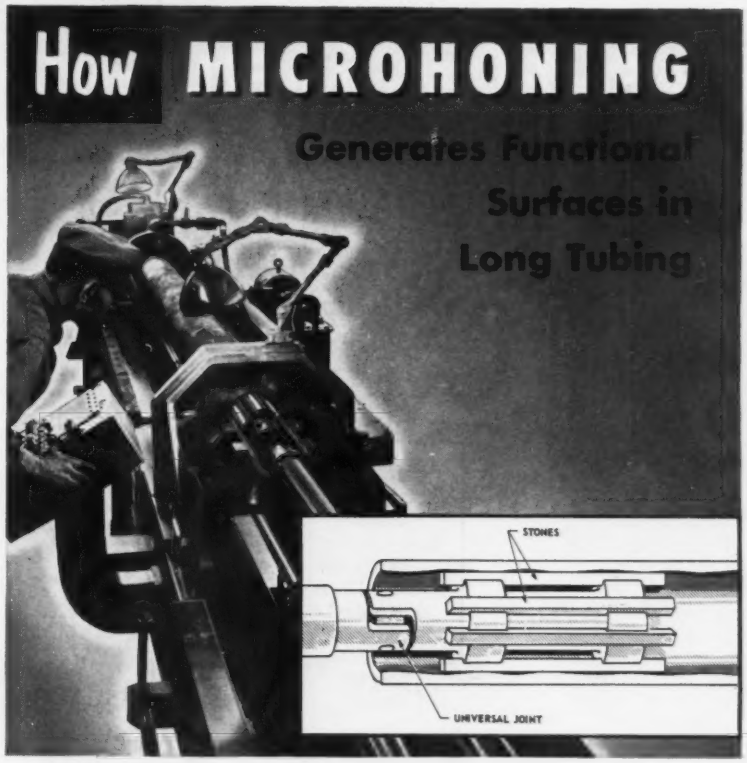
MILLING MACHINES, Knee Type, Vertical

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio

(Continued on page 348)



Microhoning is used by the Tube Reducing Corporation in processing many types of tubing that range up to 18 feet long and 9½ inches in diameter. The tubes are Microhoned on a horizontal Hydrohoner equipped with a hydraulic clamping fixture that is easily adjusted to handle tubes of various sizes.

Microhoning tools have long abrasive sticks which cannot follow irregularities in the bore. The abrasive action removes high spots while generating required surface characteristics and accurate geometry. A universal joint, connecting the tool body to the drive shaft, eliminates any tendency of abrasive action to change the bore location.

Typical processing of "Rockrite" tubes: To remove scale and deep scratches . . . hot rolled, pierced billets are first bored. Then, the bores are Microhoned—stock removal rate is .015 inch from a 4½-inch diameter x 128-inch length in less than 30 minutes. The Microhoning operation generates accurate, round, straight surfaces with the required finishes of 20 to 30 microinches r. m. s.

Send coupon for complete information.

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

MARVEL Synclinal FILTERS

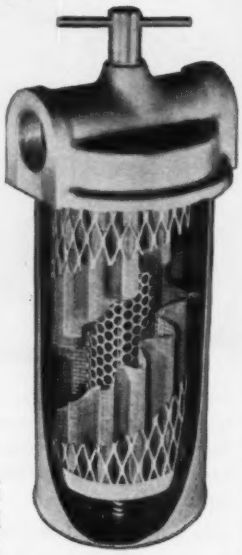
SUMP TYPE (cutaway)

For Efficient Filtration of—

Hydraulic Oils — Fire Resistant Hydraulic Fluids — Coolants — Lubricants — Water

OVER 750 Original Equipment Manufacturers Install Marvel Synclinal Filters as Standard Equipment

Meet J.I.C. Standards



LINE TYPE (cutaway)

PROTECT EQUIPMENT
INCREASE PRODUCTION
REDUCE MAINTENANCE

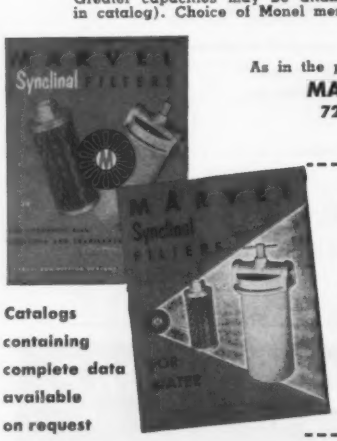
Marvel Synclinal Filters installed in the sump or on the line preceding pump offer maximum protection on all hydraulically actuated and other equipment utilizing low pressure circulating oil systems. Maintenance and production costs are reduced because Marvel Synclinal Filters BALANCED design offers greater ACTIVE filtering area with sufficient storage capacity for filtered out damaging particles, thus, longer periods of productive operation are attained at minimum "down time" due to maintenance and repairs.

PRODUCTION ENGINEERS and MAINTENANCE MEN whose job it is to keep production machinery operating at peak efficiency and who have recognized the superiority of Marvel Synclinal Filters in the filtration of hydraulic oils, fire resistant hydraulic fluids, coolants, lubricants, etc. are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel Synclinal Filters on all machines within their plants.

Another outstanding reason for their preference is the simple construction of Marvel Synclinal Filters which allows them to be easily disassembled, thoroughly cleaned and reassembled on the spot, by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.



Catalogs containing complete data available on request

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer Immediate Delivery!

MARVEL ENGINEERING COMPANY
7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: Juniper 8-6023

MY-6

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:—

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name .....

Company .....

Address .....

City ..... State .....

Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread

Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.

MOLDING MACHINES, Plastic

Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., Roselle, N. J.

MOTORS, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

Barnes, J. S., Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.

(Continued on page 350)

Saves Time... Cuts Costs

Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.

Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.

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BUILDERS OF LARGE COLD SAWING MACHINES • ROTARY PLANERS • COLUMN FACERS • HEAVY TYPES OF SPECIAL MACHINERY

Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES

Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Wales-Strippit Corp., Akron, N. Y.

NICKEL AND NICKEL ALLOYS

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricrating Oils and Greases

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co. (Tubular Prod. Div.), Beaver Falls, Penna.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld

Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

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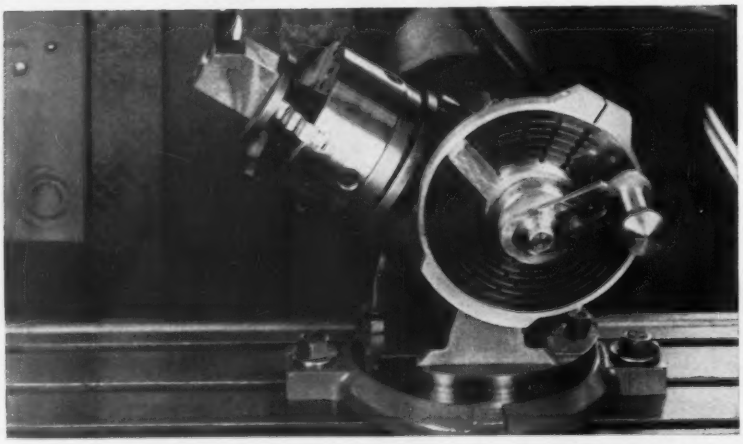
Chuck "teamwork" that gives real precision



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Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Machine Co., Inc., Waynesboro, Pa.

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Dow Chemical Co., Midland, Mich.
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

PRESS FEEDERS, Automatic

Bliss Co., E. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., East Orange, N. J.

PRESS STACKERS and STORAGE SHUTTLES

Michigan Production Eng. Co., Hazel Park, Mich.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
du Mont Corp., Greenfield, Mass.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Colonial Broach & Machine Co., Box 37, Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bath, Cyril Co., 32324 Solon Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., 1745 Overland Ave. N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 18th St., East Orange, N. J.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

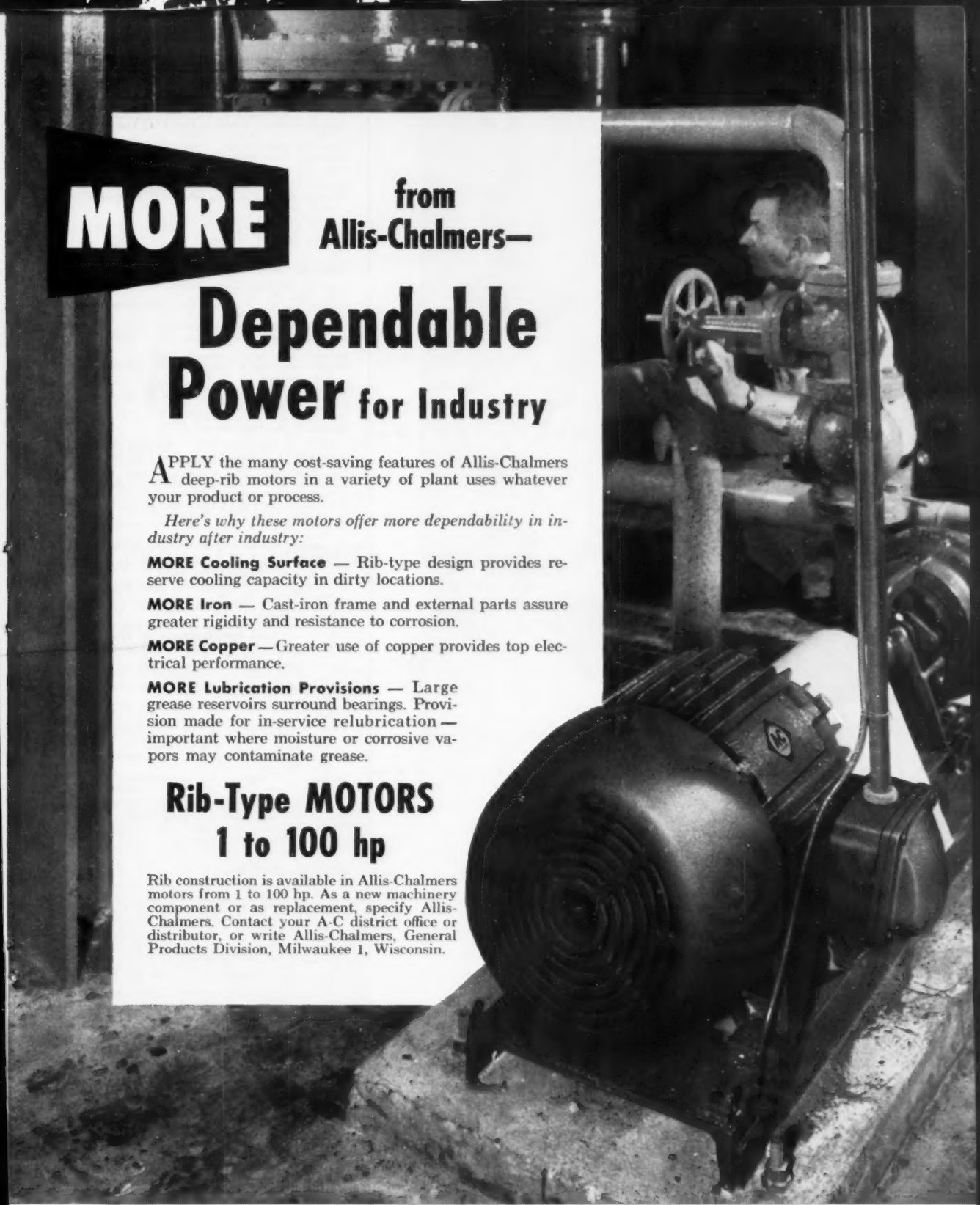
PRESSES, Foot

Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.

(Continued on page 354)



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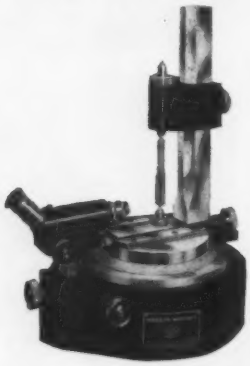
ALLIS-CHALMERS

A-5293

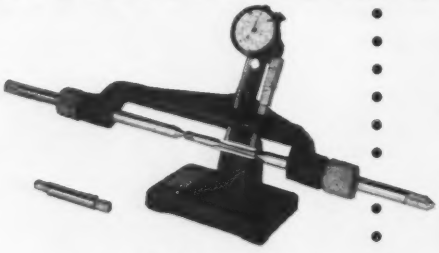
Thread Comparator (External) with Concentricity Attachment

Thread Comparator Standard Model



Optical Tap Checker

Thread Comparator (Internal) with Squareness Attachment



Tap Check Comparator

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Notching

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Bath Cyril Co., 32324 Aurora Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

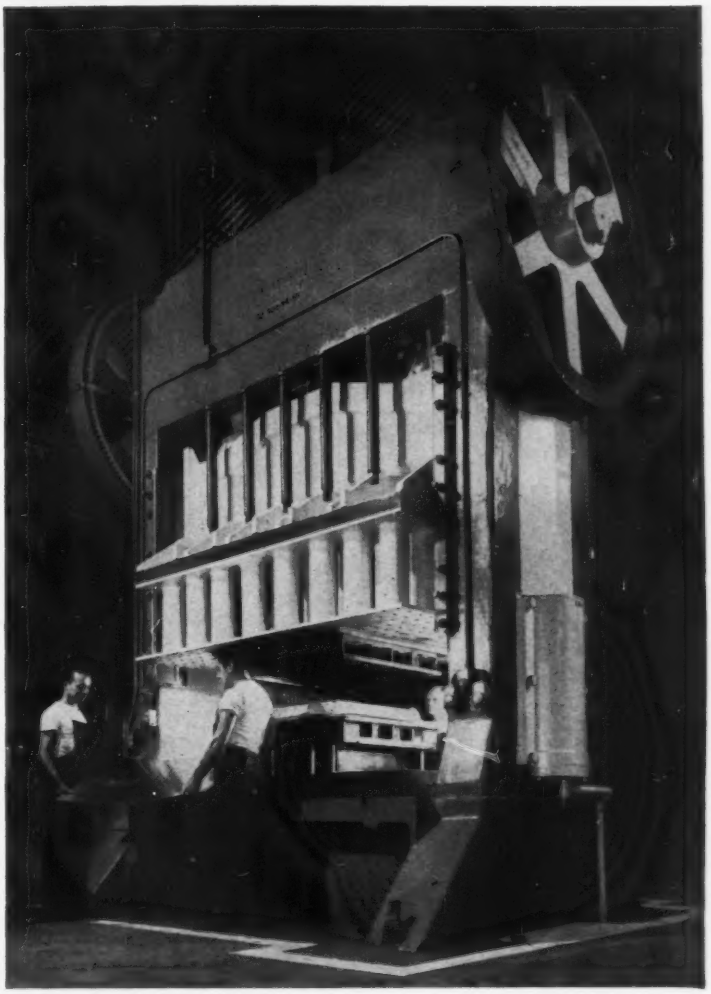
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio

(*Continued on page 356*)

Chambersburg Engineering Co., Chambersburg,

Cleveland Press speeds production at International Metal Products Company

famous **arctic circle**
air cooler parts completely formed
in just one stroke!



Cleveland Straight Sided Double Crank Press, 300 ton capacity, two 25 ton air cushions.

Cabinet fronts and grills for this famous
arctic circle
air cooler are formed in a single stroke.

"This Cleveland Press is one of our more versatile pieces of equipment. We do the greatest portion of our deep draw work on this press. The large bed area permits us to mount as many as four dies; thus we draw, blank, punch and form cabinet fronts and grills in a single stroke. We also use it for large blanking and multiple forming operations".

G. J. Rice, plant engineer at International Metal Products Co. of Phoenix, concluded his recent letter by stating,

"*Clutch performance has been outstanding.* Other than normal adjustments there has been very little maintenance required on this press".

You, like many other leading manufacturers, will find many advantages in new Cleveland Presses. There are 11 types in a wide range of sizes. One of these will exactly meet your requirements . . . will assure lower stamping costs, faster production. A Cleveland engineer will gladly advise you for most advantageous selection. Just write or call today!

The CLEVELAND Punch & Shear Works Co.
Power Presses • Fabricating Tools • Punching Tools and Dies
East 40th and St. Clair Avenue, Cleveland 14, Ohio
Offices at: New York • Chicago • Detroit • Philadelphia • East Lansing • Cincinnati

THE CLEVELAND PUNCH & SHEAR WORKS CO.
Established 1880

For more information fill in page number on Inquiry Card, on page 229

Versatility in Forming-
NILSON 4-SLIDES

Simple or complex metal forms in wire or ribbon metal is no problem on a Nilson. Tooling for basic forming can be augmented by provision for operations such as welding, assembling or swaging. Open design on all forming elements provides for quick tool change and easy adjustment even from wire to metal forming on the one machine that does so many jobs so well. The universal Nilson 4-Slide is the economical answer to your forming problems. Size ranges—wire up to ½" dia. in feeds to 32" max., ribbon stock up to 3½" wide. 5 to 75 ton press sections. Our specialists can assist you in all types of forming requirements.

THE A. H. NILSON MACHINE CO.
1518 BRIDGEPORT AVE. • SHELTON, CONN.

NILSON

Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

PULLEYS
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

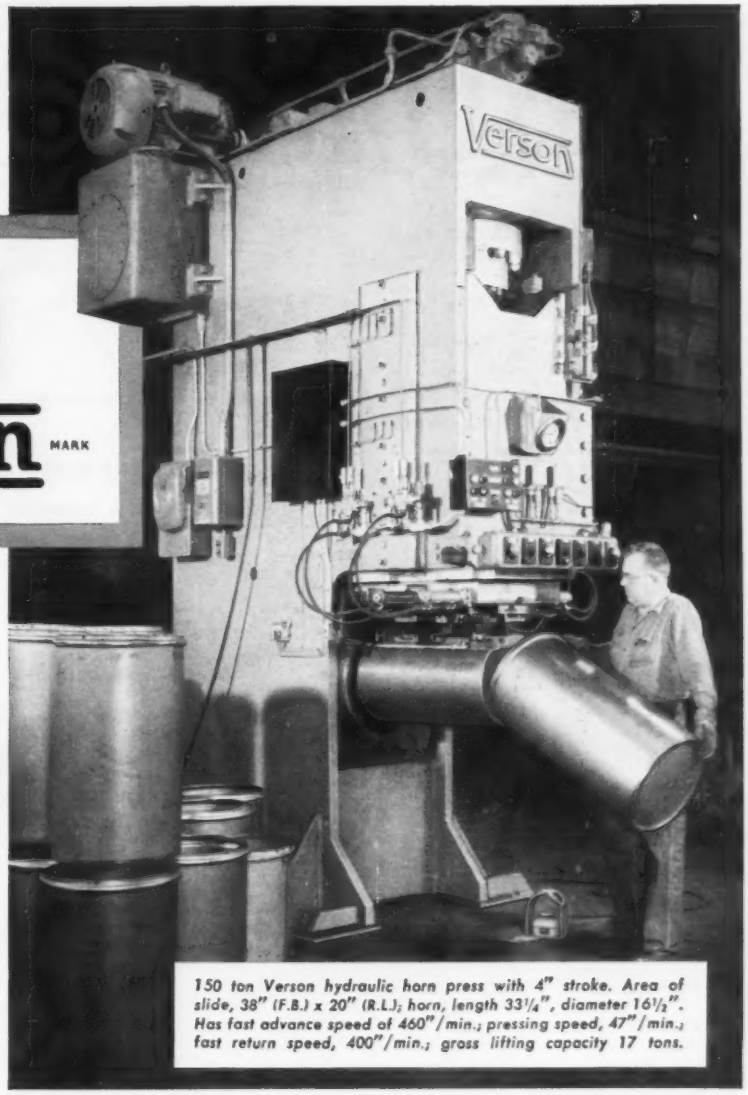
REAMERS, Rose, Chucking, Jobbers', Taper, Shell, Adjustable, etc.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Goddard & Goddard Co., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

150 TON

TRADE **Verson** MARK

hydraulic HORN PRESS

coins and pierces openings on power line transformer containers



150 ton Verson hydraulic horn press with 4" stroke. Area of slide, 38" (F.B.) x 20" (R.L.); horn, length 33¼", diameter 16½". Has fast advance speed of 460"/min.; pressing speed, 47"/min.; fast return speed, 400"/min.; gross lifting capacity 17 tons.

This 150 ton Verson hydraulic horn press is in use at the Gadsden, Alabama, Works of Allis-Chalmers Manufacturing Company.

The press is employed to automatically coin and pierce 3 different openings, to accommodate various sized leads coming into power line transformer containers. When actuated, the press has a two stroke cycle. A combination coining and piercing die coins the part on the initial stroke—the second stroke is a piercing operation.

The press is equipped with full automatic electrical control and has varying tonnage control for each of the three stations. By preselection, the operator may exert the proper tonnage required to do each specific job.

This hydraulic horn, like all Verson machines, is much more than just a press. It's a production process, engineered and built to provide greater efficiency and production with reduced costs.

Put Verson's production know-how to work for you. Send an outline of your requirements —we'll make specific recommendations.

A Verson Press for every job from 60 tons up.

TRADE **Verson** MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information fill in page number on Inquiry Card, on page 229

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, Etc.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 510 So. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

RULES, SCALES AND STRAIGHTEDGES—See Machinists' Small Tools

RUST INHIBITORS
Oakite Products, Inc., 19 Rector St., New York N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular, Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Tannewitz Works, Grand Rapids, Mich.

SAW BLADE SHARPENERS
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Tannewitz Works, Grand Rapids, Mich.

SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

SAWS, Screw-slotting—See Cutters, Milling

SCALES
Hydroway Scales, Inc., 31302 Stephenson Hwy., Madison Hts., Mich.

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Errington Mech Lab., Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Thor Power Tool Co., Aurora, Illinois
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., N. Y. 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Challenge Mchry. Co., Grand Haven, Mich.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The, L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAFTS
Cumberland Steel Co, 101 Williams St., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Thomson Ind., Inc., Manhasset, N. Y.

SHAPERS, Crank and Hydraulic
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Homestrand, Inc., Larchmont, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Western Machine Tool Works, Holland, Mich.

SHAPERS, Vertical and Slotters
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

SHEARS, Rotary and Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati 25, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SHOP FURNITURE—See Furniture, Shop

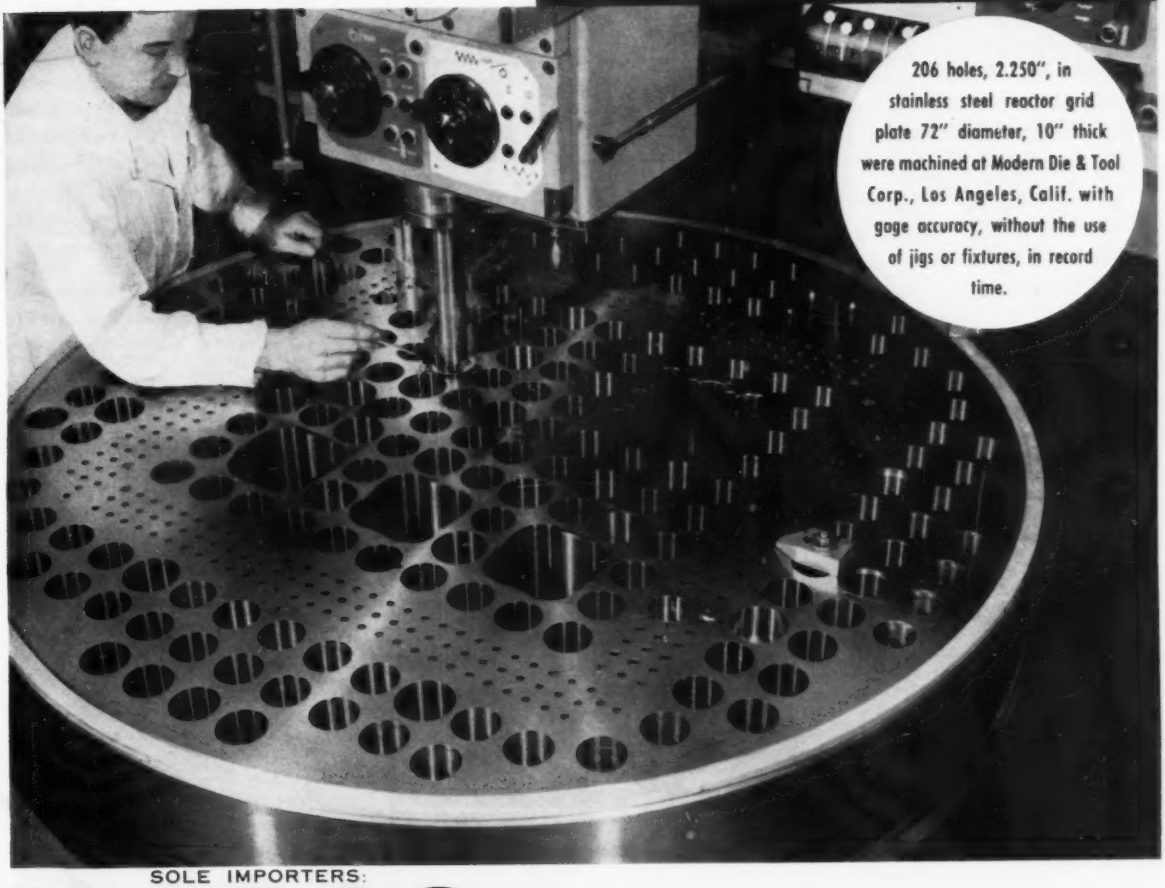
SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

(Continued on page 360)

SCHWARTZKOPFF

KBF2

AUTO-POSITIONING PRECISION BORING & MILLING MACHINE WITH PROGRAM (PUNCHED CARD) AND PRESELECTOR (SWITCH) CONTROL



206 holes, 2.250", in stainless steel reactor grid plate 72" diameter, 10" thick were machined at Modern Die & Tool Corp., Los Angeles, Calif. with gage accuracy, without the use of jigs or fixtures, in record time.

SOLE IMPORTERS:

MARAC MACHINERY CORP.

45 SOUTH BROADWAY, YONKERS, NEW YORK

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SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS

Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

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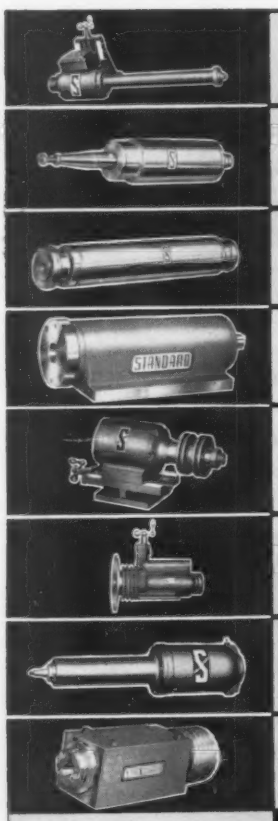
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros., & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
DoAll Co., Des Plaines, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Philadelphia Gear Works, Inc., Erie Ave., and G. St., Philadelphia, Pa.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

SPINDLES, Machine

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th-N. St., Richmond, Ind.
Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio
Wadell Equip. Co., Clark, N. J.



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SINCE 1912

HALLMARK OF METALWORKING THROUGHOUT THE WORLD

the STANDARD electrical tool co.

MAKERS OF 800 DIFFERENT SPINDLES...AND READY TO DESIGN 1000 MORE FOR INDUSTRY'S NEEDS!

WRITE TODAY: SUPER PRECISION SPINDLE DIVISION

2500 RIVER ROAD • CINCINNATI 4, OHIO

Tongue support part for New Holland baler, prepared with 75-ton Warco inclinable punch press, is shown fitted in place on Hayliner 68 assembly line at New Holland, Pa. Inspecting the job is Sub-assembly Foreman Lee. Larkin.

"Warco PRESSES ...Stand up!"

"Not a breakdown in five years," says leading farm machine manufacturer

• Several years ago New Holland Machine Company, New Holland, Pa., purchased their first Warco Press . . . an inclinable punch press. It is still working as good as the day they bought it. Since then they have added other Warcos for piercing, blanking and forming a variety of machine parts. "We find these presses very satisfactory," say New Holland officials; "in our five years of using Warcos we have never had a breakdown."

Warco Presses stand up because they are built from the frame out to deliver maximum performance in the most difficult assignments.

Using a 75-ton Warco inclinable punch press, operator Christian Good turns out tongue support parts. Watching the operation is Assistant Foreman Lester Howe. Ten-gauge hot-rolled sheet steel is used for the part.

THE FINISHED PRODUCT... Warco inclinable punch press had a hand in turning out this smart-looking, smooth-performing Hayliner 86 baler. The machine was designed to bring the average-size farm big baling capacity at smaller baler cost.

Federal® WELDERS

The Federal Machine and Welder Company

WARREN, OHIO

Warco PRESSES®

SPRAYING EQUIPMENT, Metal
Metallizing Engrg. Co., Westbury, N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL, Cold Rolled, Stainless, High-Speed, Tool, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
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U. S. Steel Corp. (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
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DoAll Co., Des Plaines, Ill.
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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
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Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
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Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

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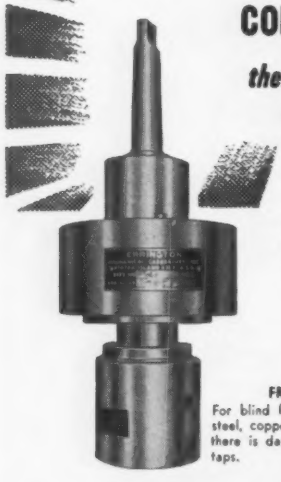

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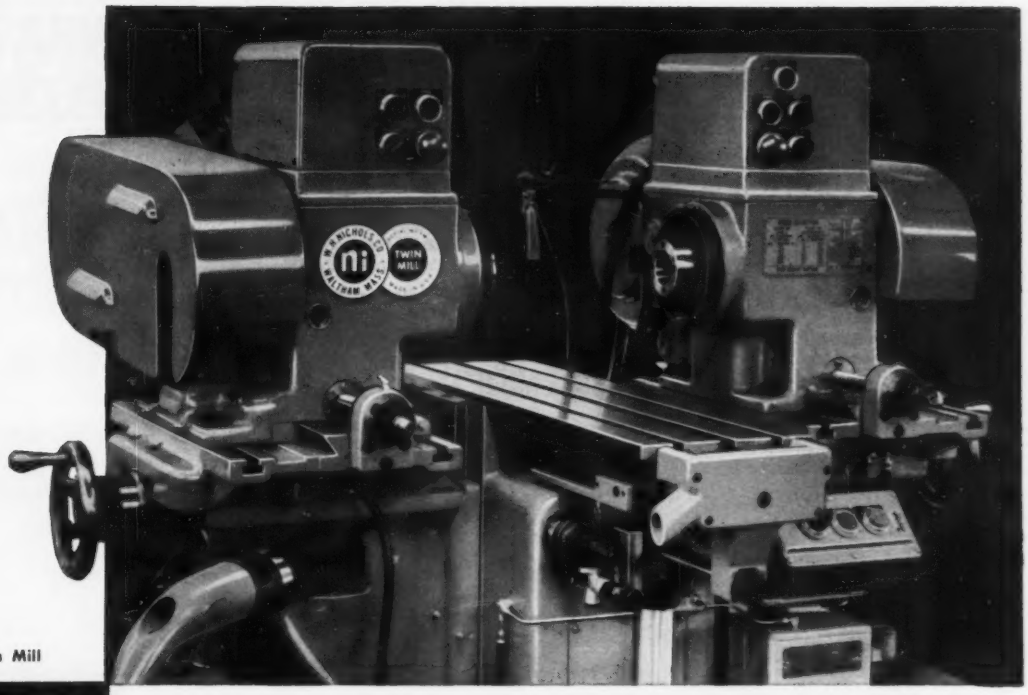

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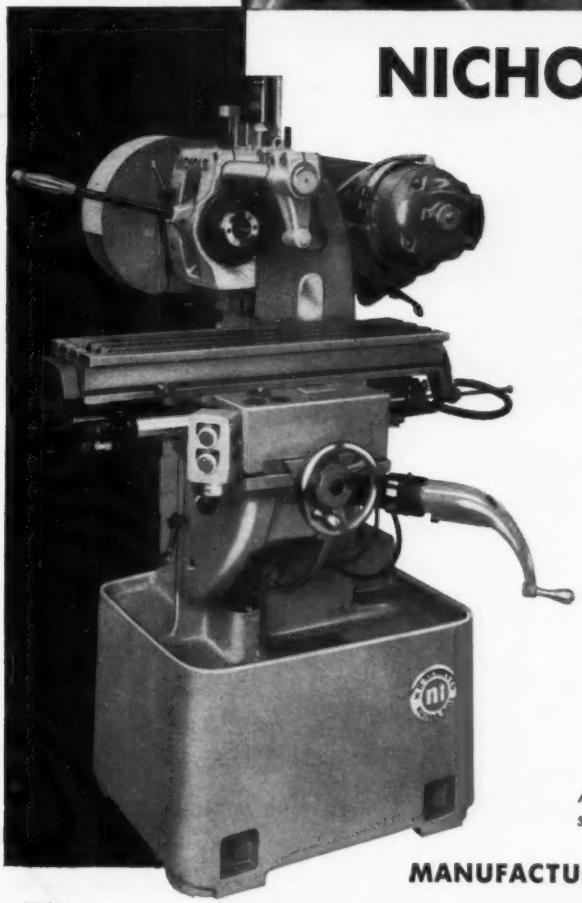

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Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
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Vascoloy-Ramet Corp., Waukegan, Ill.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
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Vanadium Alloys Steel Co., Latrobe, Pa.

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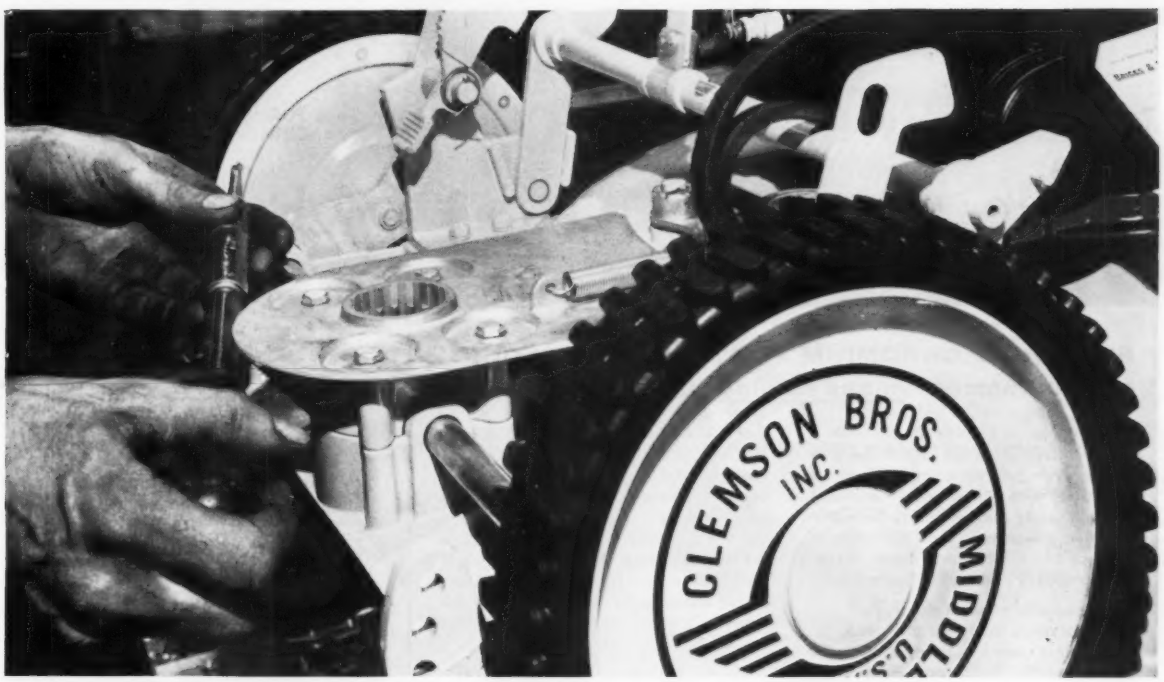

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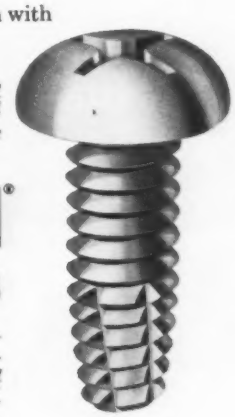

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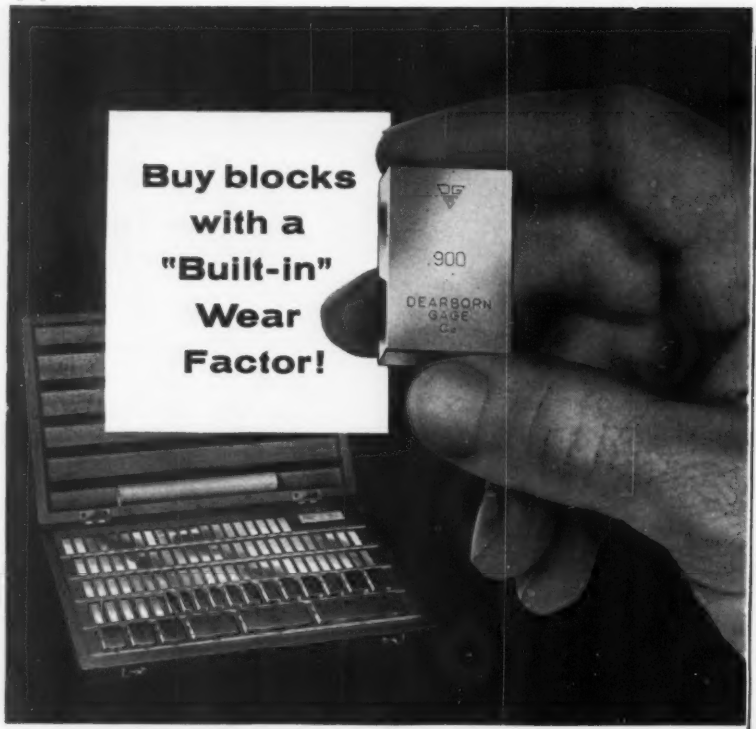

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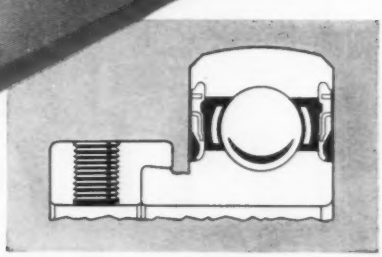

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Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.) 436 7th Ave., Pittsburgh, Pa.

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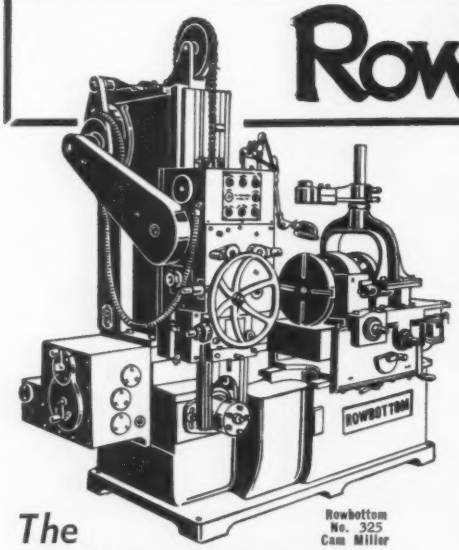
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Pope Mchry. Corp., Haverhill, Mass.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Power Chuck
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.

Rowbottom for Cams



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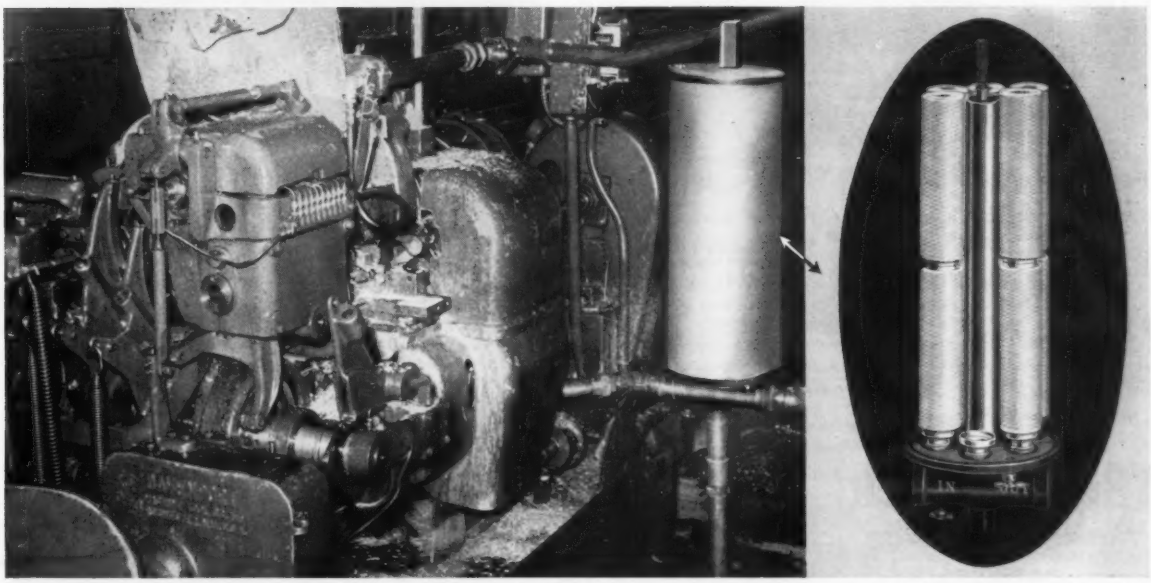

Multi-Tube Fulflo Filters reduce down time by maintaining micronic clarity of coolants and cutting oils. Note simplicity of inner assembly.

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You get the exact degree of *continuous micronic clarity* you need with Fulflo Filters — for industrial fluids of all kinds: oils; liquid chemicals; water; liquid fuels; lubricating oils; lacquers; paints; thinners; compressed air; CO_2 and other gases; commercial fluids. A wide variety of standard models handle all normal flow rates and pressures. Special models are engineered for flow rates up to 2000 gpm or pressures as high as 5000 psi, with minimum pressure drop. With Fulflo Filters, you save money by avoiding production breakdowns, protecting machinery, parts, and products, and by keeping production flowing smoothly.

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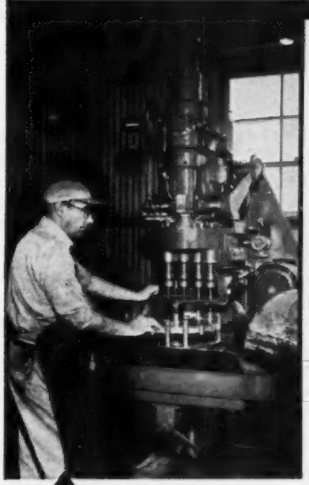

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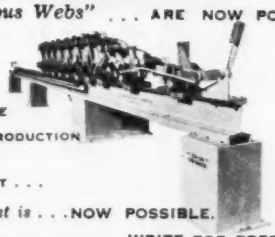

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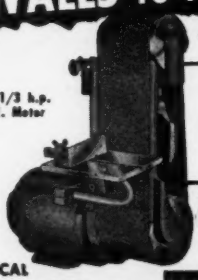

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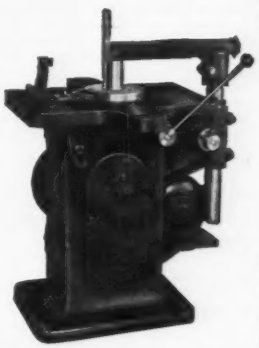

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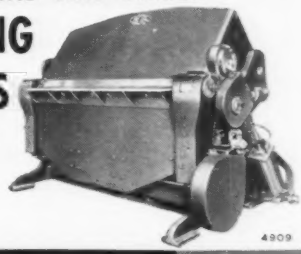

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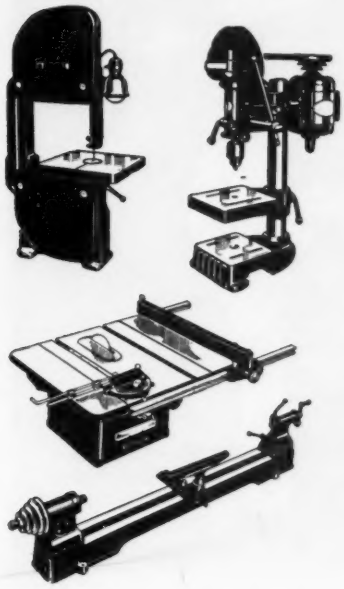

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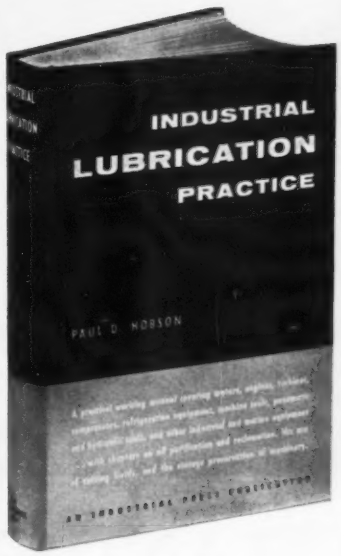

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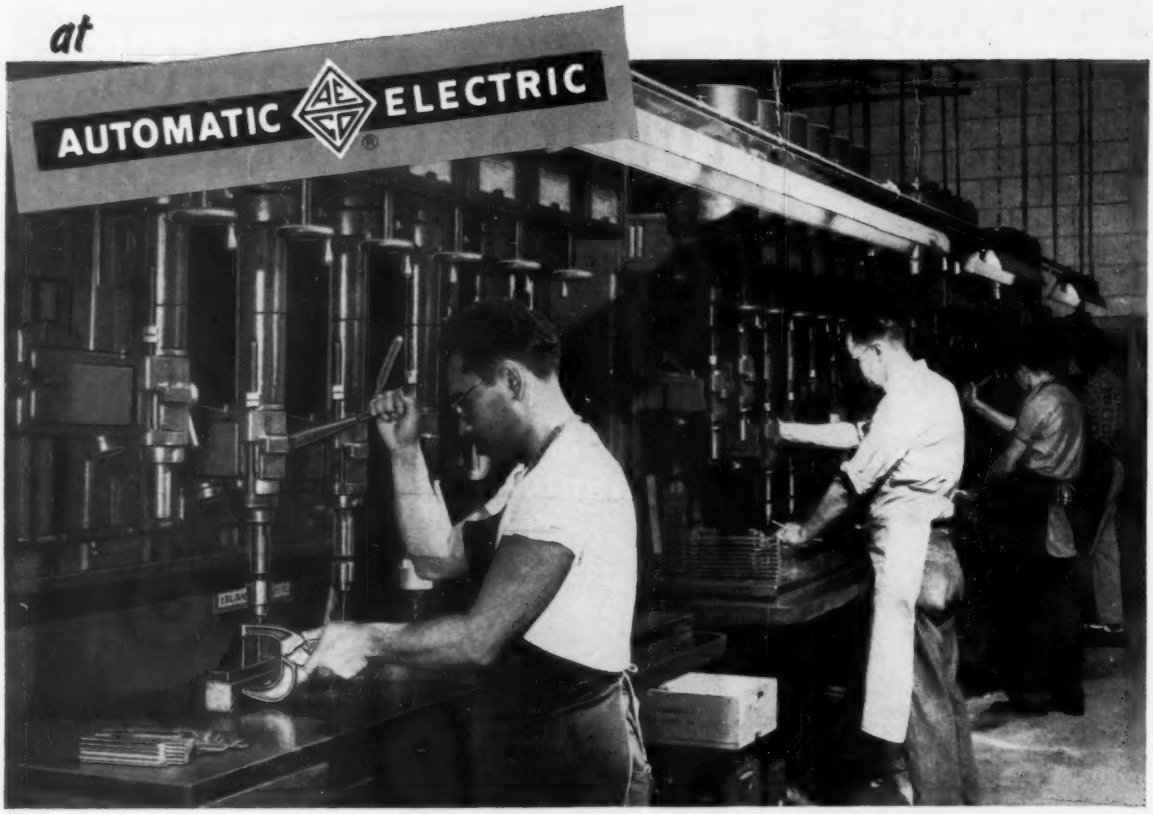

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Acme Machinery Div., Hill Acme Co. 335
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Allen-Bradley Co. Insert bet. 92-93
Allis-Chalmers Manufacturing Co. 353
American Brass Co. 307
American Broach & Mch. Co. ..... Insert bet. 77-92
American Chain & Cable 332
American Tool Works Co. 113
Armstrong-Blum Mfg. Co. 337
Armstrong Bros. Tool Co. 72
Austin Industrial Corp. 73
Automation Devices, Inc. 315
Automotive Gear Div., Eaton Mfg. Co. 271
Avey Drilling Mch Co. 48-49
Axelson Manufacturing Co., Div. U. S. Industries, Inc. 286

B

Baker Brothers, Inc. 302
Barber-Colman Co. Insert bet. 77-92
Bardons & Oliver, Inc. .. 116-117
Barnes Drill Co. Insert bet. 77-92
Bethlehem Steel Co. 101, 106
Blanchard Machine Co. 130
Bliss, E. W. Co. 119
Boston Gear Works 285
Bridgeport Machines, Inc. .. 284
Brown & Sharpe Mfg. Co. 224-225
Bryant Chucking Grinder Co. 312-313
Buck Tool Co. 350
Buffalo Forge Co. 122-123
Buhr Machine Co. Insert bet. 66-67
Bullard Co. ..... Insert 41
Bunting Brass & Bronze Co. 328
Burg Tool Mfg. Co. 20

C

Carlton Machine Tool Co. .. 293
Carpenter Steel Co. 102
Chicago Pneumatic Tool Co. 54-55
Cincinnati Gear Co. 342
Cincinnati Grinders, Inc. .. 16-17
Cincinnati Lathe & Tool Co. 110-111
Cincinnati Milling Machine Co. 6-7
Cincinnati Shaper Co. 64-65
Cities Service Oil Co. 112
Classified Advts. 374-375
Cleveland Automatic Machine Co. 241
Cleveland Crane & Engrg. Co. 62
Cleveland Punch & Shear Wks. Co. 355
Cleveland Worm & Gear Co. Inside Back Cover
Columbus Die-Tool & Mch. Co. 298
Commercial Filters Corp. 369
Comtor Co. 371
Cone Automatic Mch. Co., Inc. 131
Cone Automatic Machine Co., Inc. (Pilot Div.) 262
Continental Tool Wks. Div. of Ex-Cell-O Corp. 227
Cross Company 134-135
Crucible Steel Co. of America 96, 99, 107
Cumberland Steel Co. 100
Curtiss-Wright Corp. 324

D

Danly Machine Specialties, Inc. 127
Davis & Thompson Co. 330
Davis Keyseater Co. 373
Dayton Rogers Mfg. Co. 299
Dearborn Gage Co. 366
Delta Power Tool Div., Rockwell Mfg. Co. 301
Denison Engineering Div., American Brake Shoe Co. 28-29
Diefendorf Gear Corp. 372
DoAll Company 281
Dreis & Krump Mfg. Co. 373
duMont Corporation 364
Dykem Co. 370
Dynamatic Div., Eaton Mfg. Co. ..... Insert 75-76

E

Eastman Kodak Co. 343
Eaton Mfg. Co., Automotive Gear Div. 271
Eidal Mfg. Co. 371
Eisler Engineering Co. Inc .. 371
Elox Corp. of Michigan 66
Errington Mechanical Laboratory, Inc. 362
Espen-Lucas Machine Works 349
Ettco Tool & Machine Co., Inc. 126
European Machine Tool Exhibition 264
Eustacchio, S. 345
Ex-Cell-O Corp. .. 227, 247, 251

F

Fafnir Bearing Co. 233
Fawick Airflex Div., Fawick Corp. 109
Federal Machine & Welder Co. 361
Federal Products Corp. 14-15
Fellows Gear Shaper 4-5
Ferracute Machine Co. 334
Foote-Burt Company 278
Fosdick Machine Tool Co. 56-57
Frauenthal Div., Kaydon Engrg. Corp. 276-277

G

Gallmeyer & Livingston Co. 223
Gardner Machine Co. 21
Gear Grinding Machine Co. .. 309
General Electric Co. 94-95
Gisholt Machine Co. Insert bet. 32-33
Gits Bros. Mfg. Co. 289
G & L and Hypro Div. Giddings & Lewis Mch. Tool Co. 26-27
Gleason Works 67
Gorton, George, Machine Co. 268
Goss & DeLeeuw Mch. Co. 300
Gray, G. A., Co. 22-23
Greenlee Bros. & Co. Insert bet. 77-92

H

Hamilton Tool Co. 333
Hannifin Corporation 51
Hanson-Whitney Co. 354
Hardinge Brothers, Inc. 138
Haynes Stellite Div., Union Carbide Corp. 98
Heald Machine Co., The Inside Front Cover, 34-35
Heller Tool Co. 260-261
Hendey Machine Div., Barber-Colman Co. .. Insert bet. 77-92
Hill Acme Co. 335
Hoglund Engineering & Mfg. Co. 290
Horton Chuck Div., Greenfield Tap & Die Corp. 295
Houston Grinding & Mfg. Co., Inc. 373
Hunt, C. B. & Son, Inc. 308
Hydraulic Press Mfg. Co. 263
Hy-Pro Tool Co. 74

I

Illinois Gear & Machine Co. 273
Industrial Filtration Co. 296

J

Jacobs Manufacturing Co. Front Cover
James, D. O., Gear Mfg. Co. 372
Jones & Lamson Machine Co. 118, 132, 245, 255

K

Kaufman Mfg. Co. 371
Kearney & Trecker Corp. .. 18-19
Kennametal, Inc. 323

L

Landis Machine Co. 2-3
Landis Tool Co. 10-11
Lapointe Machine Tool Co. 60-61
LeBlond, R. K., Machine Tool Co. 30-31
Leland-Gifford Co. 376
Lincoln Electric Co. 270
Linde Co., Div. Union Carbide Corp. 42
Lodge & Shipley Co., The 272
Lovejoy Tool Co., Inc. 371

M

M. B. 1. Export & Import, Ltd. 341
Madison-Kipp Corp. 280
Mahon, R. C. Co. 50
Marac Machinery Corp. 359
Marlin-Rockwell Corp. 325
Marvel Engineering Co. 348
Materials Section 93-108
Mattison Machine Works Insert bet. 77-92
Metal Carbides Corp. 329
Metallizing Engineering Co., Inc. 326
Metallurgical Products Dept. of General Electric Co. 94-95
Michigan Tool Co. Insert bet. 108-109
Micromatic Hone Corp. 346-347
Minster Machine Co. 124-125
Monarch Machine Tool Co. 256-257
Morris Machine Tool Co. 243
Morris, Robert E., Co. 363
Mummert-Dixon Co. 373

N

National Acme Co. 46-47
National Automatic Tool Co., Inc. 70-71
National Broach & Mch. Co. 133
National Machinery Co. 292
New Departure, Div. General Motors 367
New Jersey Gear & Mfg. Co. 372
Niagara Machine & Tool Works 36-37
Nilson, A. H., Machine Co. 356
Norton Company 33, 52-53, 69

ALPHABETICAL LIST OF ADVERTISERS

O

Oakite Products, Inc. 104
Ohio Crankshaft Co. 279
Oilgear Co. 339
Oliver Instrument Co. 58-59
Orban, Kurt Co., Inc. 235
Osborn Mfg. Co. 40
Ottemiller. Wm. H., Co. 373

P

Pangborn Corporation 378
Parker-Kalon Div., General American Transportation Corp. 365
Perry Equipment & Eng. Co. 315
Philadelphia Gear Works, Inc. 32
Pittsburgh Plate Glass Co. .. 298
Pope Machinery Corp. 253
Portage Machine Co. 288
Potter & Johnston Co. 303
Pratt & Whitney Company, Inc. 304-305
Production Feeder Corp. 370

R

Reliance Electric & Engineering Co. 319
Revere Copper & Brass, Inc. 269
Robbins, Omer E. Co. 265
Rockford Die & Tool Works Inc. 370
Rockford Machine Tool Co. Insert bet. 77-92
Ross Operating Valve Co. 317
Rowbottom Machine Co. 368
Russell, Burdsall & Ward Bolt & Nut Co. 228
Russell, Holbrook & Henderson, Inc. 43
Ruthman Machinery Co. 344
Ryerson, Joseph T. & Son, Inc. 140

S

Saginaw Steering Gear Div., General Motors Co. 259
Scherr, Geo. Co., Inc. 373
Scott Paper Co. 351
Seneca Falls Mch. Co. 121
Sheffield Corp. Insert bet. 258-259
Sheldon Machine Co., Inc. 322
Shell Oil Co. 311
Shenango Furnace Co. 318
Sidney Machine Tool Co. 237
Simonds Abrasive Co. 275
Simonds Saw & Steel Co. 321
Size Control Co., Div. American Gage & Machine Co. 39
Skinner Chuck Co. 331
Snyder Tool & Engrg. Co. 44-45
Springfield Machine Tool Co. 128-129
Stahl Gear & Machine Co. 372
Standard Electrical Tool Co. 360
Standard Oil Co., (Indiana) 114-115
Standard Pressed Steel Co. 38, 108
Starrett, L. S., Co. 248
Sundstrand Machine Tool Co. ..... Insert bet. 77-92

T

Tannewitz Works 314
Texas Company 136
Thompson Grinder Co. 267
Thomson Industries, Inc. 97
Threadwell Tap & Die Co. Insert bet. 258-259
Thriftmaster Products Corp. 370
Timken Roller Bearing Co. Back Cover
Timken Roller Bearing Co. Steel & Tube Div. 103
Tomkins-Johnson Co. 297
Townsend, H. P. Manufacturing Co. 310
Triplex Machine Tool Corp. 371
Twin Disc Clutch Co. 266

U

U. S. Burke Machine Tool Div. 282
U. S. Tool Company, Inc. .. 12-13
Union Carbide Corp., Haynes Stellite Co. 98
Union Carbide Corp., Linde Co. Div. 42
United States Steel Corp. 93
Universal Engineering Co. 287
Used Machinery 374-375

V

Van Keuren Co. 294
Van Norman Machine Co. 8-9
Vascoloy-Ramet Corp. 239
Verson Allsteel Press Co. 357
Vickers, Inc. Div. Sperry Rand Corp. 63
Viking Pump Co. 306
Virginia Gear & Machine Co. 32

W

Wagner Brothers, Inc. 291
Waldes Kohinoor, Inc. 283
Walker, O. S., Co., Inc. 320
Wallace Supplies Mfg. Co. 372
Walls Sales Corp. 372
Walsh Press & Die Co., Div. American Gage & Machine Co. 39
Warner & Swasey Co. 24-25
Wesson Co. ..... Insert bet. 42-43
Western Machine Tool Works 327
Whitman & Barnes, Inc. 120
Wiedemann Machine Co. 274
Wilson, K. R. Inc. 316
Wilson Mechanical Instrument Div., American Chain & Cable 332

Y

Yoder Co. 68

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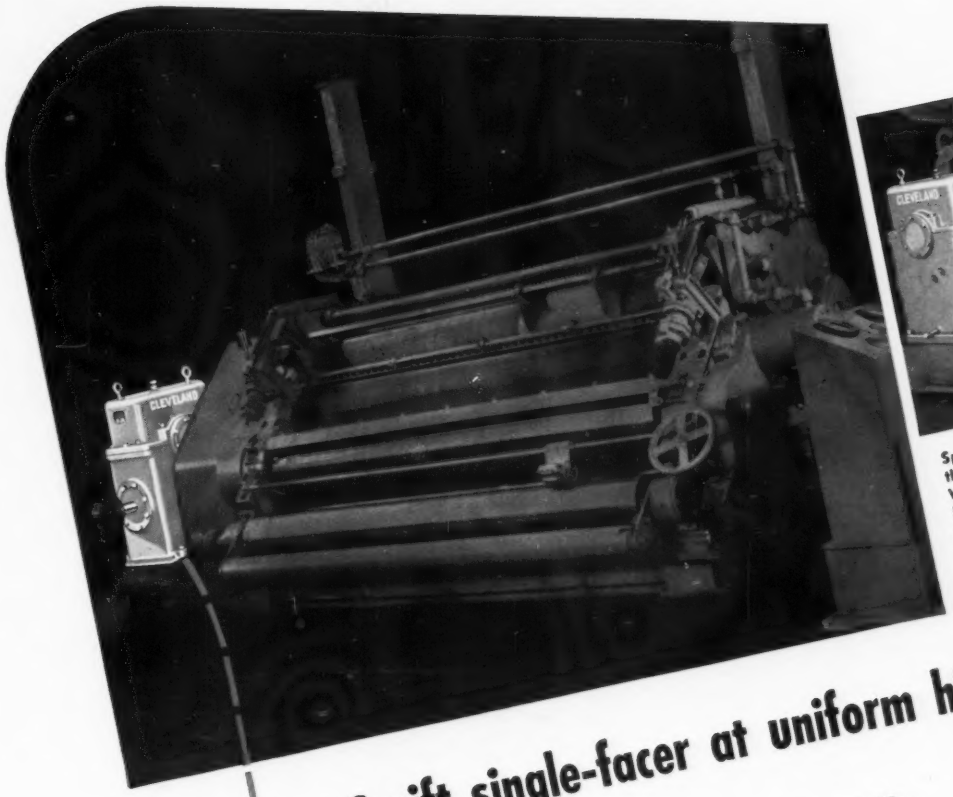

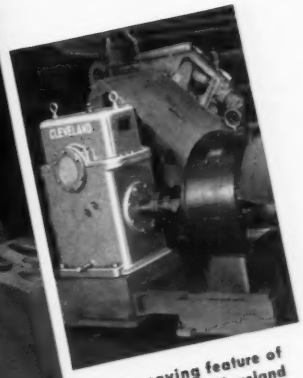

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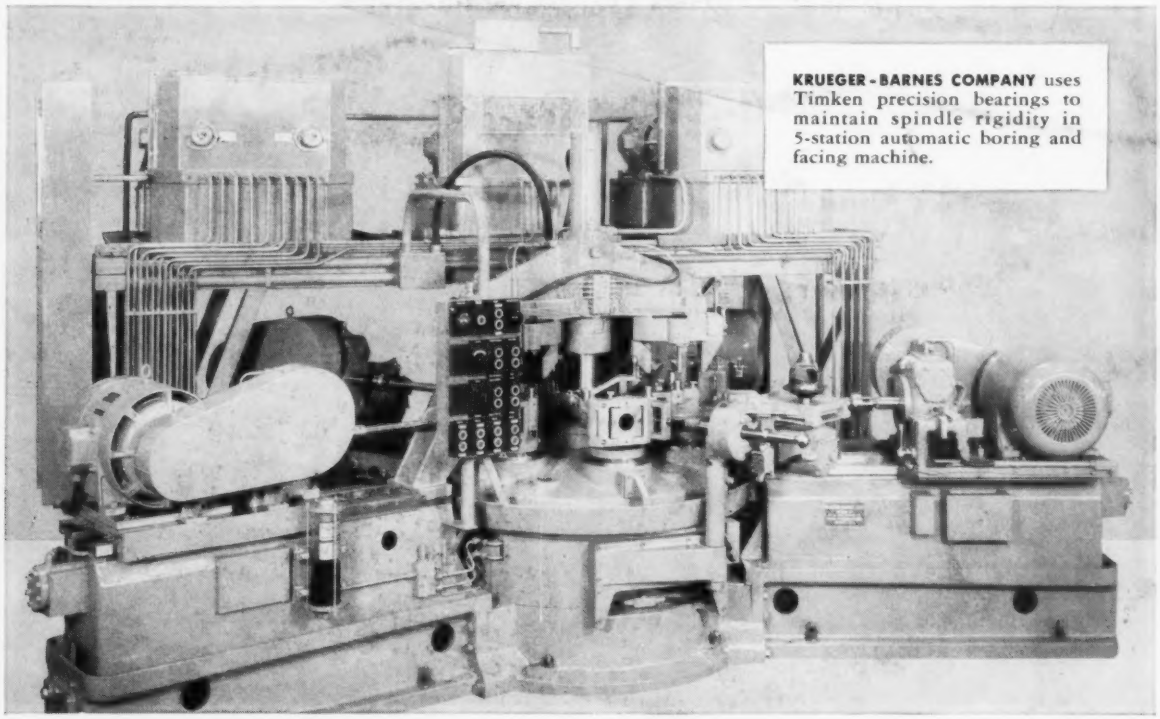

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